Landsat 7 Processing System (LPS)
Output Files
Data Format Control Book

November 10, 1995

GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

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Abstract

This Data Format Control Book (DFCB) presents detailed data formats for the Level 0R files generated by the Landsat 7 Processing System (LPS). A Level 0R file set includes an image data file for each Enhanced Thematic Mapper Plus (ETM+) band, a mirror scan correction data (MSCD) file, a payload correction data file (PCD), and a calibration data file. The LPS also generates WRS scene level reduced size browse images (files) from ETM+ Format 1 bands and a metadata file for all data received and processed for a subinterval. The LPS uses the Hierarchical Data Format (HDF) for storing these files in the LPS and for transferring to the Land Processes Distributed Active Archive Center LP DAAC) of the EOSDIS Core System (ECS).

This document provides a current understanding of the definition of the LPS output data formats generated by the LPS. This data format control book will be baselined by the LPS Project for delivering Landsat 7 output data files to the LP DAAC.

Keywords: Data Format Control Document (DFCB)
Landsat 7 Processing System (LPS)
Land Processes Distributed Active Archive Center (LP DAAC)

Preface

This DFCB is controlled by the Landsat 7 Project office of the Mission Operations and Data Systems Division (MODSD) and may be updated by Document Change Notice (DCN) or revision. Comments and questions regarding this DFCB should be directed to:

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Acronym List

Section 1 — Introduction

1.1 Purpose

This data format control book (DFCB) defines detailed formats of the output (Level 0R, metadata and browse) files available at the Landsat 7 Processing System (LPS) for transfer to the Landsat Processes Distributed Active Archive Center (LP DAAC).

The LPS output file formats described in this DFCB are based on the requirements contained in the LPS Functional and Processing Specification and the Interface Control Document between the EOSDIS Core System (ECS) and the Landsat 7 System.

1.2 Scope

This DFCB describes detailed file formats for the Level 0R processed ETM+ band data, payload correction data (PCD), calibration data and mirror scan correction data (MSCD) files generated by the LPS. This DFCB also provides detailed formats for the Level 0R metadata and multi-browse image files, also generated by the LPS. These file formats are applicable to the interface between the ECS LP DAAC and the LPS. This DFCB does not describe the file formats of the Landsat 7 Level 0R data items/sets required by the Landsat 7 users. Detailed formats of the Level 0R files/products required by the Landsat7 users community are defined in a separate Landsat 7 Project ICD.

The scope of this DFCB is limited to describing the LPS output files formats, The Functional, performance, operational and interface design details for the transfer of these files from LPS to the LP DAAC are contained in the ICD between the ECS and the Landsat 7 System. The LPS output file formats defined in this DFCB are based on Landsat 7 ETM+ instrument and payload correction data (PCD) data details provided in the Landsat 7 Data Format Control Book, the LPS F&PS, the ECS-LP DAC ICD and HDF guideline documents available from the ECS Project.

1.3 Intended User's

This document is intended as a supplements to LPS-LP DAAC ICD. Therefore, the LPS and the EOSDIS Projects are the primary users of this document. This document contains detailed information on the LPS output data formats to allow users on both the LPS and EOSDIS project sides to proceed with independent development of the LPS and LP DAAC (systems).

This DFCB provides detailed information on the contents of the LPS Level 0R output files (Band, mirror scan correction data, payload correction data and Calibration data) and the metadata and browse image associated with these files. Both the LP DAAC and Landsat 7 users are interested in this data. The primary intention of the data formats contained in this DFCB is to support the development of the direct interface between the LPS and the LP DAAC. The Level 0R details contained in this DFCB are also adequate to serve the initial information need of the Landsat 7 users. The Landsat 7 Project is presently developing a separate (interface control) document to provide complete details on the Landsat t 7 Level 0R output files/products desired by the Landsat 7 users/scientist community .

Section 2 — Documentation

The following documents provide more detailed information regarding the LPS, the LGS, and the Landsat 7 system. If there are conflicts between the listed documents and the requirements of this ICD, the requirements of this ICD shall be considered to be the superseding requirements

2.1 Applicable Documents

1. NASA GSFC/MO&DSD, Landsat 7 Processing System (LPS) Functional and Performance Specification (F&PS), Revision 1, 560-8FPS/0194, July 28, 1995.

2. NASA GSFC, Interface Control Document (ICD) between the EOSDIS Core System (ECS) Landsat 7 System , Final, 209-CD-013-001, July 1995.

3. National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) Landsat 7 Detailed Mission Requirements, May 15, 1995.

4. Martin Marietta Astro Space (MMAS), Landsat 7 System Data Format Control Book (DFCB), Volume 4 - Wideband Data, 23007702, December 2, 1994

5. Hughes Applied Information Systems, Inc., HDF-EOS Primer for Version 1 EOSDIS, White Paper, 175-WK-001-001, April 1995.

6. Hughes Applied Information Systems, Inc., The HDF-EOS Swath Concept, White Paper, WBS-WP-xxx-yyy **(TBD)**, June 1995.

7. CCSDS Recmmendation for Space Data System Standards, Parameter Value Language - A Tutorial, CCSDS 641.0-G-1, Green Book Issue 1, May 1992.

2.2 Reference Documents

These documents are provide background information.

1. GSFC/MO&DSD, Systems Management Policy, MDOD-8YMP/0485, July, 1986

2. NASA GSFC/MO&DSD, Landsat 7 Processing System (LPS) Operations Concept, Revision 1, 560-3OCD/0194, August 25, 1995.

3. NASA GSFC/MO&DSD, Interface Definition Design (IDD) Document, Draft, 560-1IDD/0195, July 1995.

4. MO&DSD Mission Operations Concept Document for the Landsat 7 Ground System, June 5, 1995.

6. GSFC, EOSDIS Browse Delivery Package Description, Preliminary Draft, June 23, 1995.

Section 3 — LPS Output Files Overview

3.1 Level 0R Files

The primary outputs of the LPS consist of Level 0R files, the metadata (file) and browse image files. The Level 0R files include ETM+ instrument band data, mirror sweep correction data (MSCD), payload correction data (PCD) and calibration data files. The band file(s) contain majority of the Level 0R processed science data collected from the Landsat 7 ETM+ instrument. A Level 0R band file contains reformatted, unrectified sub-interval data having a sequence of pixels which are spatially consistent with the ground coverage. The radiometric calibration, attitude, and ephemeris data, associated with the band file, are provided in the payload correction and calibration data files. The MSCD file provides additional scan related information for subsequent processing of the band file data to Level 1R.

3.1.1 Band Data File

Each band file contains the image data from a single band in a single sub-interval. The data is grouped by detectors, i.e., for a given major frame, detector 1 data is followed by detector 2 data, etc. Reverse scans are reversed. This data is nominally aligned using fixed and pre-determined integer-pixel values (provides alignment for band offset, even/odd detectors, and forward and reverse scans). Data quality indicators are appended with each major frame.

3.1.1 Mirror Scan Correction Data File

One MSCD file is created for each sub-interval. This file contains the Scan Line Data extracted from the two minor frames following the End of Line Code (EOL) in each major frame of the sub-interval . The Scan Line Data (SLD) includes the first half scan error (FHS ERR), the second half scan error (SHS ERR), and the Scan direction (SCN DIR) information. The time of the major frame corresponding to this data is appended.

3.1.1 Payload Data File

One PCD file is created for each sub-interval. This file contains the PCD major frames received during a subinterval on a full PCD cycle basis. PCD quality indicators are appended on major frame basis.

3.1.1 Calibration Data File

One file is created for each sub-interval. This file contains all of the calibration data received on a major frame basis for a given sub-interval. This is the data received after the Scan Line Data (which follows the End of Line Code) and before the next major frame sync, as described in the Landsat 7 Wideband data DFCB. The data is grouped by detectors, i.e., for a given major frame, detector 1 data is followed by detector 2 data, etc. Reverse scans are reversed. The time of the major frame corresponding to this data is appended, as well as the status data.

3.2 Metadata File

One metadata file is created for each sub-interval. The metadata contains information on the Level 0R data provided in the sub-interval, the names of the Level 0R instrument data, calibration data, payload correction data, mirror scan correction data and browse image files associated with the sub-interval. Metadata also contains quality and accounting information on the return link wideband data used in generating the level 0R file(s). In addition, metadata includes quality and accounting information on received and processed PCD, and cloud cover assessment for the WRS scene contained in the sub-interval. The metadata is used by LP DAAC users to determine the sub-interval and/or WRS scene level quality of the Level 0R data stored in the LP DAAC archive before ordering it on a cost basis.

3.3 Multi-browse File

A multibrowse file is a reduced data volume file of the Level 0R data which can be viewed on a scene basis to determine general ground area coverage and spatial relationships between ground area coverage and cloud coverage. The browse image data from 3 predetermined bands of the ETM+ Format 1 scene data are contained in the multi-band browse file. This file contains reduced resolution single scenes of the full resolution scene data contained in the Level 0R band data files of a subinterval.

3.4 Hierarchical Data Format (HDF)

The EOSDIS project has selected the Hierarchical Data Format (HDF) for exchanging data with external systems. The EOSDIS Projects also uses the HDF for storing the received data in its active archives. The HDF allows a standard data structures for various types of data. Details on the various data structures supported by the HDF are provided in Applicable Document 5. The LPS uses the following HDF data structure for its output files:

Table 3-1: LPS Oytput Files HDF Data Structures

LPS File	ETM+ Foramt		Contents	HDF Structure
Band 1 Image Data	1		Binary	Swath / SDS
Band 2 Image Data	1		Binary	"
Band 3 Image Data	1		Binary	"
Band 4 Image Data	1		Binary	"
Band 5 Image Data	1		Binary	"
Band 6 Image Data	1		Binary	"
Band 6 Image Data		2	Binary	Swath / SDS
Band 7 Image Data		2	Binary	"
Band 8 Image Data		2	Binary	"
Mirror Scan Correction Data (MSCD)	1	2	ASCII Text	P=V (PVL)
Payload Correction Data	1	2	Mixed	VData
Calibration Data	1	2	Binary	Swath / SDS
Metadata	1	2	ACII Text	P=V (PVL)
- Subinterval Level Metadata	1	2		
- WRS Scene Level Metadata	1	2		
- ACCA Results	1			
- Level 0R Q&A	1	2		
Browse Image Data	1		Binary	RIS24
(Band Sequential Format)				

This version of the LPS DFCB contains detailed information on the contents of each LPS output file. Sufficient details are provided in the contents of each output file to define the HDF output data structures. A PVL example for the metadata file is provided to illustrate the use of one such HDF data structure. Examples of other data structures will be added to this DFCB in subsequent revisions.

3.5 File Naming Convention

The File naming convention for LPS output files is as follows:

File Name: L7XssssfnYYDOYHHuuv.xxx where:

L7 indicates the Landsat 7 mission
X = 1, 2 or 3 for the L7 X-band used to downlink data to the LGS

sss indicates ground station source indicator, for example:
sss = EDC at Sioux Falls, SD
sss = ANC for Anchorage, Alaska
(EDC uses 3 letter ground station name in a figure in the LPS Ops Concept)

f indicates ETM+ data format:
f = 1 for Format 1 data
f = 2 for Format 2 data
n indicates LPS processor number (1-9)

YYDOYHH: indicates Landsat 7 contact period receive date, time, where:
YY = Last two digit of year associated with a contact period
DOY = day of year (001 through 366) associated with contact period
HH = hour of the contact period within a 24 hour day (00-23)

uu indicates a Sub-interval number within this contact period (00- 99)
v indicates dataset version number:
v = 0 for original
v = 1 - 9 for reprocessed data.

xxx indicates an LPS File type; the following file types are used in LPS:
xxx = Bis for band files where:
B indicates a "Band File",
i indicates the :Band ID "1 through 7" for image bands 1 - 7, and
"P" for the Panchromatic band 8,
s indicates the file segment number s = 0 for "one segment file only",
s = 1 - 4 for Pan Band file segments

xxx = MSD for an MSCD file
xxx = PCD for a PCD file
xxx = CAL for a Calibration File
xxx = MTA for a Metadata File
xxx = Rnn for Multi-Browse File where nn (01-99) indicates the WRS scene number identified in the metadata file.

Section 4 — LPS Output Files Data Formats

4.1 Level 0R Files

This section contains details on the LPS Level 0R output file formats. The Level 0R files include:

- Band Files
- Mirror Scan Correction Data File (MSCD)
- Payload Correction Data File (PCD)
- Calibration Data file

The LPS generates two sets of Level 0R files, one for Format 1 data and another for Format 2 data. LPS generates 6 Band files (Bands 1 - 6), one MSCD files, one PCD file and one calibration data file for Format 1 data. For Format 2 data, the LPS generates 3 band (Bands 6 - 8), one MSCD, one PCD and one calibration data files. The following section provide details on the contents of each Level 0R file.

4.1.1 Band File Format

4.1.1.1 Band File Overview

The LPS generates two sets of band files for the ETM+ Format 1 and Format 2 Data. Bands 1 through 6 Level 0R files are generated for Format 1 data. Bands 7 through 8 are produced for Format 2 data. Each Band file consists of a common format as shown in Figure 4-1 and summarized in Table 4-1.

The Band file consists of three types of records, a file descriptor, a data descriptor and a data record type. The file descriptor provides information on how to identify the file and its overall structure. The file descriptor includes information such as a file name, creation date and time and the number of segments a file consists of. The data descriptor record provides information on provides a summary level information on the data contained in the file. This information may include information such as the total count records in a file, first and last record data and times and roll-up data (total scans). Data records presents the actual data in definable unit levels such as a major frame or a scan line.

The following sizing assumptions are used in defining the valid range of values for the parameter fields includes in the band files.

1. Scans per Scene:
   - Minimum: 325
   - Average: 350
   - Maximum: 375

2. Scan Data Lines per Scene:
   - Bands 1 - 5 and 7: 350 x 16 = 5600 (Average)
   - Band 6: 325 x 8 = 2600 (Minimum)
   - Band 8: 375 x 32 = 12000 (Maximum)

3. Subinterval Duration: 14 minutes
   (The longest possible contact period duration - worstcase)

4. Scene Duration: ~ 24 seconds

5. Number of Scenes per Subinterval: ~ 35
   (The longest possible contact period with a single subinterval)

6. ETM+ Scans per Subinterval:
   Minimum: 325 x 35 = 11,375
   Average: 350 x 35 = 12,250
   Maximum: 375 x 35 = 13,125

7. Scan Data Lines per Subinterval:
   - Bands 1 - 5 and 7: 5600 x 35 = 196,000 (Average)
   - Band 6: 2600 x 35 = 91,000 (Minimum)
   - Band 8: 12000 x 35 = 420,000(Maximum - all 4 file segments)
   - Band 8: 12000 x 35 = 105,000(Maximum - 1 of 4 file segments)

8. Scan Data Line Lengths:
   - Band 1 - 5 and 7: 6313 Bytes (minor frames, average)
   - Band 6: 6313 / 2 = ~ 3157 Bytes
   - Band 8: 6313 x 2 = 12,626 Bytes

9. Subinterval Sizes:
   - Band 1 - 5 and 7: 196,000 x 6313 = ~ 1.24 GB
   - Band 6: 91,000 x 3157 = 0.288 GB
   - Band 8: 420,000 x 12,626 = ~ 5.3 GB
   - Band 8 Segment: 5.3 / 4 =~ 11.3 GB (for each of 4 segments)

Note 1: Detector order for ascending orbit is shown.
Note 2: After Pixel alignment, a nominal scan line is approximately 6100 - 6175 Bytes long.

Figure 4-1: LPS Band Output File Format Overvie - Band 2 Example

Table 4-1: Band File Format Summary

Field	Length (Bytes)	Remarks
File Descriptor		
File Record No. 1	6	
File Name	22	
File Creation Date & Time	16	
File Version No.	2	
File Source ID	12	
Total File Segments	1	
File Segment No.	1	Applicable to Band 8 file only
Software Version No.	4	
IAS Parameter Version No.	4	
Data Descriptor		
File Record No. 2	6	
Spacecraft ID	8	
ETM+ Format	2	
Sub-interval start time	20	
Sub-interval stop time	20	
Total Scans	6	in this subinterval
Band ID	2	
Detectors per Band (d)	2	
Scan Data Line Length	6	Line length for majority of scan data lines
Total Scan Data Lines	6	in this subinterval
Data Records		**The following fields are repeated for each Band-Detector Data Scan Data Line in the subinterval**
File Record No. 3	6	
Scan Number N	6	where: 325 < N < 375 (Average: 350 scans)
Scan Direction	2	
Scan start time	22	

Band ID	2	
Detector ID	2	
Scan Data Line Count (L)	6	where: 325xM < L < 375 x d Average L: 350 x d
Scan Data Line Offset - LHS	4	
Scan Data Line Offset - RHS	4	
Band Gain Status	1	**Scan Line Quality Info.**
Band Gain Change Flag	1	/
CADU Sync Flag	1	/
Scan Sync Flag	1	/
Scan Time Flag	1	/
Scan End-of-Line (EOL) Flag	1	/
Minor Frame Fault Flag	1	/
Scan Data Line (Pixel Data)	~12660	**Scan Data Line - Band-Detector Pixels**

4.1.1.2 Band File Description

Table 4-2 contains detailed Description on the contents of the Level 0R Band file.

Table 4-2: Band File Format Description

Attribute (Field) Name	Attribute (Field) Name and Description	Type	Field Size (Byte)	Field Format / Valid Range / Value ($ sign indicates a blank space)
File Descriptor				
File Record No.	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000001 indicates that this is the start of the file descriptor record
File Name	Landsat 7/LPS Standard File Name **(TBR)** Note 1: The Level 0R file naming scheme described here has been review by the Landsat 7 and the ECS Projects. Additional concurrence from International Ground Station is required.	Char	22	L7XsssfnYYDOYHHuuv.xxx where: L7 indicates the Landsat 7 mission X = 1, 2 or 3 for the L7 X-band used to downlink data to the LGS sss indicates ground station source indicator, for example: sss = EDC at Sioux Falls, SD sss = ANC for Anchorage, Alaska (EDC uses 3 letter ground station name in a figure in the LPS Ops Concept) f indicates ETM+ data format: f = 1 for Format 1 data f = 2 for Format 2 data n indicates LPS processor number (1-9) YYDOYHH: indicates Landsat 7 contact period receive date, time, where: YY = Last two digit of year associated with a contact period DOY = day of year (001 through 366) associated with contact period HH = hour of the contact period within a 24 hour day (00-23) uu indicates a Sub-interval number within this contact period (00- 99) v indicates dataset version number: v = 0 for original v = 1 - 9 for reprocessed data.

File Name (contd.)				xxx indicates an LPS File type; the following file types are used in LPS: xxx = Bis for band files where: B indicates a "Band File", i indicates the :Band ID "1 through 7" for image bands 1 - 7, and "P" for the Panchromatic band 8, s indicates the file segment number s = 0 for "one segment file only", s = 1 - 4 for Pan Band file segments xxx = MSD for an MSCD file xxx = PCD for a PCD file xxx = CAL for a Calibration File xxx = MTA for a Metadata File xxx = Rnn for Multi-Browse File where nn (01-99) indicates the WRS scene number identified in the metadata file.
File Creation Date & Time	LPS system date and time when this file was created. This time may vary from file to file within the same Level 0R file set. Note: The time format in CAPITAL letters indicates LPS/Local system generated time.	Time	16	$YY:DDD:HH:MM:SS where: YY: Julian Year (00 through 99) DDD: Day (01 through 366) HH: hours (00 through 23) MM: minutes (00 through 59) SS: seconds (00 through 59) The time is in the range from 00:001:00:00:00 to 99:365:23:59:59
File Version No.	Reprocessing indicator to distinguish this file from the Level 0R file generated earlier for the same sub-interval and provided to the LP DAAC. The reprocessing information may be tracked by LPS or entered by an operator during setup of the reprocess operation. **(TBR)**	Intgr	2	$R: where $ indicates a "blank space" R = 0 indicates "not a reprocessed file" R = 1 through 9" indicates the file reprocess count value

File Source ID	This field identifies the country, responsible agency and the source system which created this file.	Char	12	CCCAAAAASSSn where: CCC indicates country name such as USA AAAAA indicates responsible agency such as "NOAA" in the case of LPS. SSS indicates the source ground station (e.g. EDC) and or a system such as the LPS. n indicates the source system string number (1 to 9) which generated the file
Total File Segments	This fields indicates the total number segments making this file is segmented. This field is used to indicate LPS Band 8 file segments.	Intgr	1	S = 0 indicates that this file is a single file with no segments. S = 1 -4 indicates the total number of segments making this file.
File Segment No.	Applicable only to the LPS Panchromatic (Band 8) file. This field allows LPS to segment a Band 8 subinterval into smaller segments to overcome system/data storage and transfer limitations.	Intgr	1	N = 0 indicates that this file is a single file with no segments. N = 1 - 4 indicates the file segment number for this file. LPS allows from 1 to 4 segments for its Band 8 (Panchromatic Band) file.
Software Version No.	Version number of the software on the source system when this file was created.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
IAS Parameter Version No.	The version No. of the IAS Parameter file used in generating this file.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
Data Descriptor				
File Record No.	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000002 indicates the data descriptor record

Spacecraft Identification	Spacecraft identification as reported in the SCID field (bits 2 through 9) of the first valid CADU of the first ETM+ (scan) reported in this file. A valid CADU/VCDU has no errors.	Char	8	Landsat7
ETM+ Format	This field identifies the ETM+ Format 1 or 2, applicable for providing an allowable band data in this file. The ETM+ format information is extracted from the PCD/Status data field of the first valid VCDU of the first major frame of the sub-interval reported in this file. A valid VCDU has no errors.	Char	2	Fn where: Fn = F1 for ETM+ Format 1 data Fn = F2 for ETM+ Format 2 data
Sub-interval Spacecraft Start Time	The spacecraft time extracted from the timecode minor frames of the first ETM+ major frame of the sub-interval reported in this file. (Note: The year information (Capitalized) is appended by LPS to the ETM+ timecode format.)	Time	20	$YY:ddd:hh:mm:ss.ttt with a range YY: Last two digits of Julian Year ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) The time is in the range from: 00:001:00:00:00.000 through 99:366:23:59:59.999
Sub-interval Spacecraft Stop Time	The spacecraft time extracted from the timecode minor frames of the last ETM+ major frame of the sub-interval reported in this file.	Time	20	$YY:ddd:hh:mm:ss.ttt with a range YY: Last two digits of Julian Year ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) The time is in the range from: 00:001:00:00:00.000 through 99:366:23:59:59.999

Total Scans (S)	The total number of ETM+ scans reported in this subinterval file. A maximum of 13,125 scans can be received in a 14 minute subinterval (based on a maximum of 35 scenes, each consisting of at most 375 scans)	Intgr	6	SSSSSS in the range of 000325 to 13,125
Band ID	For Band Files, this field identifies the ETM+ band selected for providing data in this file. Only a single band data is included in an LPS Band file.	Char	2	$B where: B indicates an ETM+ band ID, 1 to 7 and P for the Panchromatic Band in this field.
Detectors per Band (d)	This field indicates the total number of detectors associated with the single band reported in this file. This field is not applicable to non-band data files.	Intgr	2	dd where: dd = 8 (detectors) for Band 6 dd = 16 (detectors) for Bands 1, 2, 3, 4, 5, and 7 dd = 32 (detectors) for Band 8 dd = NA for not applicable cases (PCD, MSCD, etc.)
Scan Data Line Length (n)	A scan line is formed by assembling data from one of the many detectors of the selected band during one ETM+ scan (major frame). The nominal scan line length (in bytes) depends on the ETM+ band selected for this file. The nominal number of minor frames in a major frame (scan) are expected to increase with bumper wear over years. This requires that the scan line length field should be able to accept 17 additional minor frames for each of Bands 1 -5 & 7 to account for this bumper wear. Scan line sizes are also adjusted by 9 and 34 minor frames (bytes) for Bands 6 and 8, respectively.	Intgr	6	nnnnnn where, nominally: nnnnnn = 006330 for Bands 1 to 5 and 7 nnnnn = 003165 for Band 6 (either Format 1 or Format 2) nnnnn = 012660 for Band 8 (Pan) Note: Band 6 data is not repeated.

Total Scan Data Lines (k)	The actual number of scan data lines collected in this subinterval file are calculated as follows: B1, 2, 3, 4, 5, or 7: Total scans * 16 B6: Total scans(s) * 8 B8: Total scans * 32	Intgr	6	kkkkkk in the range from: 002600 for Band 6 for the smallest sub-interval period (1 scene with a minimum of 325 scans) to 210,000 for Band 6 for the longest sub-interval (35 scenes each consisting of a maximum of 375 scans Note: A Band 8 subinterval may contain a maximum of 420,000 scan data lines. This subinterval will, however, be segmented into 4 equal size files, each containing a maximum of 105,000 scan data lines.
Data Records				
File Record No.	This field contains a sequence number for this data record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ in the range from 000003 to 012000 QQQQQQ = 3 indicates the first data record in this band file.
Scan Number N	The field provides a sequence counter for the ETM+ scans (major frame) contained in the sub-interval . The ETM+ scan counter is incremented by one for each new scan, real or flywheeled, added to the sub-interval. This number can be as high as 13,125 for a maximum size sub-interval of 14 minutes.	Intgr	6	SSSSSS where: SSSSSS is in the rages from 000325 to 013125
Scan Direction	The ETM+ scan direction information interpolated from the Scan Line Data (SLD) minor frames of the first ETM+ major frame reported in this file.	Char	2	D$: where D = "F" for a Forward received scan D = "R" for a Reverse received scan

Scan Start Time	Indicates the ETM+ scan start time extracted from the time code minor frames of the ETM+ major frame reported in this data record. A computed scan start time is provided if valid time not available from the time code minor frames.	Time	22	YY:ddd:hh:mm:ss.ttt:ff with a range from 00:001:00:00:00.000:00 through 99:366:23:59:59.999.15 where: YY: Last two digits of Julian Year DDD: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) ff: Sixteenths of a millisecond (00 through 15)
Band ID	This field identifies the single band, selected from any of Bands 1 through 6 for Format 1 and 6 through 8 for Format 2, used for providing data in this band file.	Char	2	Bn where B is a prefix for band ID, and n = 1, 2,3, 4, 5, 6, 7, or P (Band 8)
Detector ID	This field identifies the single detector of the selected band used in forming and providing the scan data line in this record of this band file. Data from each detector of the selected band is reported once, either in an incrementing (for a ascending orbit) or in a decrementing order (for a descending orbit), during each scan, forward or reverse. **TBR: D**o we know orbit condition here? Does it matter which detector order the data is organized, as long as the detector order is maintained throughout an interval?	Intgr	2	dd where: dd= A single detector number in the range from 01 to 32 Band 1 - 5 & 7: Max. 16 detectors Band 6: Max. 8 detectors Band 8: Max. 32 detectors The selected detector number is incremented (or decremented) for each new scan line (see also the Band File overview Figure)
Scan Data Line Count (L)	The Scan Data Line Counter is incremented for each Band-Detector line added to the subinterval band file. This counter is incremented once per ETM+ scan for Bands 1 - 5 and 7, once every two ETM+ scans for Band 6, and twice for each ETM+ scan for Band 8.	Intgr	6	SSSSSS where: SSSSSS is in the rages from 002600 (Band 6 of 1 scene) to 420,000 (Band 8 of 35 scenes) Note: This counter is not reset when a Band 8 file is segmented.

Scan Data Line Offset - LHS **(TBR)**	The scan line data in each record of the band file is initially written with a predetermined size of byte off-set on the left and right of the designated scan line data area. These offsets are provided to accommodate scan line length growth due to ETM+ scanner bumper wear. Later, during band-detector alignment, these offsets are adjusted (without any data loss) to provide the valid start and stop bytes/pixel positions for the scan line contained in this field. (See also Band File overview figure).	Intgr	4	LTTT where: L denotes the LHS offset TTT: number of bytes in the range from 00 to 200 **(TBR)** The scan line data offset is initially set to 20 bytes filled with the value "0" Detector-band pixel alignment may increase this offset to a maximum of 194 bytes. **(TBR)**
Scan Data Line Offset - RHS **(TBR)**	Same as for "Scan Line Margin - Left Hand Side"	Intgr	4	RTTT where: R denotes the RHS offset, TTT: number of bytes in the range from 00 to 200 **(TBR)** The scan line data offset is initially set to 20 bytes filled with the value "0" Detector-band pixel alignment may increase this offset to a maximum of 194 bytes. **(TBR)**
Band Gain Status	The band gain information is extracted from the first PCD/status data field of the first valid VCDU used in construction of the ETM+ major frame corresponding to this scan data line.	Char	1	G where: G = L indicates a "low gain", and G = H indicates a "high gain"
Band Gain Change Flag	Indicates the change in band gain during this scan line.	Char	1	C where: C = 0 indicates no change in band gain for this line C = 1 indicates a change in band gain for this line.
CADU Sync Flag	Indicates if CADU sync was dropped during this scan (major frame)	Char	1	L where: L = 0 indicates no CADU sync loss L = 1 indicates CADU sync losses

Scan Sync Flag	Indicates if a real/valid sync was detected for this ETM+ scan line (major frame) or not.	Char	1	S where: S = 0 indicates a real/valid sync S = 1 indicates a flywheeled sync
Scan Time Flag	Indicates if a valid timecode was received for this scan (major frame) or not.	Char	1	T where: T = 0 indicates a real/valid time code T = 1 indicates a computed timecode
Scan End of Line (EOL) Flag	Indicates if a real/valid End-of-Line (EOL) Pattern Code was detected or not.	Char	1	E where: E = 0 indicates a real/Valid EOL E = 1 indicates a flywheeled EOL
Minor Frame Fault Flag **(TBR)**	Indicates the quality of this scan by indicating the range of minor frames found missing/faulty and filled by the system. **NOTE: This flag is not currently specified in LPS design. EDC does not need it. IAS/Rich Irish likes to use this flag for IAS trending analysis.**	Char	1	N where N for a range of minor frame faults (m) is as follows: N = 0 indicates no faulty minor frames N = 1 for 1 <= m <=2 N = 2 for 3<= m <= 4 N = 3 for 5<= m <= 8 N = 4 for 9 <= m <= 16 N = 5 for 1 <= m <= 32 N = 6 for 1 <= m <= 64 N = 7 for 1 <= m <= 128 N = 8 for 1 <= m <= 256 N = 9 for 1 <= m <= 512 N = A for 1 <= m<= 1024 N = B for 1 <= m <= 2048 N = C for 1 <= m <= 4096 N = D for 1 <= m<= 8192 N = E for 1 <= m <= 12,660 (Pan Band (8) only) N = F for 1 <= m <= not defined

Scan Data Line (Band-Detector Pixel Data)	This field contains all data bytes collected from a single detector of the selected band to form a scan line. The scan line data LHS and RHS offsets indicate the actual start and end of a valid scan line after pixel alignment.	Binary	3165 - 12660	Data Bytes 1 through n where: n = 6330 for Bands 1, 2, 3, 4, 5 or 7 or n = 3165 for Band 6 or n = 12660 for Band 8 Nominal values for n are shown. They include 17 minor frames for bumper wear. Band-detector alignment may decrease the nominal value of n by a maximum of 194 bytes for each band type. All data bytes are 8-bit binary words with a decimal value in the range from 4 to 255. (Fill data/pixels contain "0s'.

NOTES/Assumptions:

1. Lower case and uppercase times denotes spacecraft and local system times, respectively

4.1.1.3 Band File Format

Band Files are stored in LPS and transferred to the LP DAAC in the HDF Swath format. Guidelines for converting the LPS band output files to the HDF Swath format are provided in Applicable Document 2.1.6.

4.1.2 Mirror Scan Correction Data File Format

4.1.2.1 MSCD File Overview

Table 4-3: MSCD File Format Summary

Field	Length (Bytes)	Remarks
File Descriptor		
File Record No 1	6	
File Name	22	
File Creation Date & Time	16	
File Version No.	2	
File Source ID	12	
Total File Segments	1	
File Segment No.	1	Applicable to Band 8 file only
Software Version No.	4	
IAS Parameter Version No.	4	
Data Descriptor		
File Record No. 2	6	
Spacecraft ID	8	
ETM+ Format	2	
Sub-interval start time	20	
Sub-interval stop time	20	
Total Scans	6	
Data Records		**The following fields are repeated for each scan in the subinterval MSCD file**
File Record No. 3	6	**mscd**
Scan No. N	6	Where 325 < N < 120,000 Scan
Scan Direction	2	
Scan start time	22	/

FHS ERR Count	5	/
SHS ERR Count	5	/
CADU Sync Flag	1	**mscd quality**
Scan Sync Flag	1	/
Scan Time Flag	1	/
Scan End-of-Line (EOL) Flag	1	/
Minor Frame Fault Flag	1	/
Computed Scan Length	5	Missing Scans are filled with 0s

4.1.2.2 MSCD File Description

Detailed description on the contents of the MSCD file is provided in Table 4-4.

Table 4-4: MSCD File Format Description (non-HDF)

Attribute (Field) Name	Attribute (Field) Name and Description	Type	Field Size (Byte)	Field Format / Valid Range / Value ($ sign indicates a blank space)
File Descriptor				
File Record Number	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000001 indicates that this is the start of the file descriptor record
File Name	Landsat 7/LPS Standard File Name **(TBR)** Note 1: The Level 0R file naming scheme described here has been review by the Landsat 7 and the ECS Projects. Additional concurrence from International Ground Station is required.	Char	22	L7XsssfnYYDOYHHuuv.xxx where: L7 indicates the Landsat 7 mission X = 1, 2 or 3 for the L7 X-band used to downlink data to the LGS sss indicates ground station source indicator, for example: sss = EDC at Sioux Falls, SD sss = ANC for Anchorage, Alaska (EDC uses 3 letter ground station name in a figure in the LPS Ops Concept) f indicates ETM+ data format: f = 1 for Format 1 data f = 2 for Format 2 data n indicates LPS processor number (1-9) YYDOYHH: indicates Landsat 7 contact period receive date, time, where: YY = Last two digit of year associated with a contact period DOY = day of year (001 through 366) associated with contact period HH = hour of the contact period within a 24 hour day (00-23) uu indicates a Sub-interval number within this contact period (00- 99) v indicates dataset version number: v = 0 for original v = 1 - 9 for reprocessed data.

File Name (contd.)				xxx indicates an LPS File type; the following file types are used in LPS: xxx = Bis for band files where: B indicates a "Band File", i indicates the :Band ID "1 through 7" for image bands 1 - 7, and "P" for the Panchromatic band 8, s indicates the file segment number s = 0 for "one segment file only", s = 1 - 4 for Pan Band file segments xxx = MSD for an MSCD file xxx = PCD for a PCD file xxx = CAL for a Calibration File xxx = MTA for a Metadata File xxx = Rnn for Multi-Browse File where nn (01-99) indicates the WRS scene number identified in the metadata file.
File Creation Date and Time:	LPS system date and time when this file was created. This time may vary from file to file within the same Level 0R file set. Note: The time format in CAPITAL letters indicates LPS/Local system generated time.	Time	16	$YY:DDD:HH:MM:SS where: YY: Julian Year (00 through 99) DDD: Day (01 through 366) HH: hours (00 through 23) MM: minutes (00 through 59) SS: seconds (00 through 59) The time is in the range from 00:001:00:00:00 to 99:365:23:59:59
File Version Number:	Reprocessing indicator to distinguish this file from the Level 0R file generated earlier for the same sub-interval and provided to the LP DAAC. The reprocessing information may be tracked by LPS or entered by an operator during setup of the reprocess operation. (TBR)	Char	2	$R: where $ indicates a "blank space" R = 0 indicates "not a reprocessed file" R = 1 through 9" indicates the file reprocess count value
File Source Identification	This field identifies the country, responsible agency and the source system which created this file.	Char	12	CCCAAAAASSSn where: CCC indicates country name such as USA AAAAA indicates responsible agency such as "NOAA" in the case of LPS. SSS indicates the source system such as LPS n indicates the source system string number (1 to 9) which generated the file

Total File Segments	This fields indicates the total number segments making this file is segmented. This field is used to indicate LPS Band 8 file segments.	Intgr	1	S = 0 indicates that this file is a single file with no segments. S = 1 -4 indicates the total number of segments making this file.
File Segment No.	Applicable only to the LPS Panchromatic (Band 8) file. This field allows LPS to segment a Band 8 subinterval into smaller segments to overcome system/data storage and transfer limitations.	Intgr	1	N = 0 indicates that this file is a single file with no segments. N = 1 - 4 indicates the file segment number for this file. LPS allows from 1 to 4 segments for its Band 8 (Panchromatic Band) file.
Software Version Number:	Version number of the software on the source system when this file was created.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
IAS Parameter Version No.	The version No. of the IAS Parameter file used in generating this file.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
Data Descriptor				
File Record Number	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000002 indicates the data descriptor record
Spacecraft Identification	Spacecraft identification as reported in the SCID field (bits 2 through 9) of the first valid CADU of the first ETM+ (scan) reported in this file. A valid CADU/VCDU has no errors.	Char	8	Landsat7
ETM+ Format	This field identifies the ETM+ Format ,1 or 2, applicable for providing an allowable band data in this file. The ETM+ format information is extracted from the PCD/Status data field of the first valid VCDU of the first major frame of the sub-interval reported in this file.	Char	2	Fn where: Fn = F1 for ETM+ Format 1 data Fn = F2 for ETM+ Format 2 data

Sub-interval Spacecraft Start Time	The spacecraft time extracted from the timecode minor frames of the first ETM+ major frame of the sub-interval reported in this file. (Note: The year information (Capitalized) is appended by LPS to the ETM+ timecode format.)	Time	20	$YY:ddd:hh:mm:ss.ttt with a range YY: Last two digits of Julian Year ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) The time is in the range from: 00:001:00:00:00.000 through 99:366:23:59:59.990
Sub-interval Spacecraft Stop Time	The spacecraft time extracted from the timecode minor frames of the last ETM+ major frame of the sub-interval reported in this file.	Char	20	$YY:ddd:hh:mm:ss.ttt with a range YY: Last two digits of Julian Year ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) The time is in the range from: 00:001:00:00:00.000 through 99:366:23:59:59.990
Total Scans (S)	The total number of ETM+ scans reported in this subinterval file. A maximum of 13,125 scans can be received in a 14 minute subinterval (based on a maximum of 35 scenes, each consisting of at most 375 scans)	Intgr	6	SSSSSS in the range of 000325 to 13,125
Data Records				
File Record No.	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Char	6	QQQQQQ in the range of 000,003 to 999,999

Scan No. N	The field provides a sequence counter for the ETM+ scans (major frame) contained in the sub-interval . The ETM+ scan counter is incremented by one for each new scan, real or flywheeled, added to the sub-interval. This number can be as high as 13,125 for a maximum size sub-interval of 14 minutes.	Intgr	6	SSSSSS where: SSSSSS is in the rages from 000325 to 013125
Scan Direction	The ETM+ scan direction information interpolated from the Scan Line Data (SLD) minor frames of the first ETM+ major frame reported in this file.	Char	2	$D: where D = "F" for a Forward received scan D = "R" for a Reverse received scan
Scan Start Time	Indicates the ETM+ scan start time extracted from the time code minor frames of the ETM+ major frame reported in this data record. A computed scan start time is provided if valid time not available from the time code minor frames.	Char	22	YY:ddd:hh:mm:ss.ttt:ff with a range from 00:001:00:00:00.000:00 through 99:366:23:59:59.999.15 where: YY: Last two digits of Julian Year DDD: Day (01 through 366) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) ff: Sixteenths of a millisecond (00 through 15)
FHS ERR Count	The first half scan error (FHS ERR) interpolated from the Scan Line Data (SLD) minor frames of the first ETM+ major frame reported in this file. This filed is in the range from +/- 000 to +/- 8192 **(TBR).**	Intgr	5	SFFFF: where S = + or - FFFF is in the range from 0000 through 9999
SHS ERR Count	The second half scan error (SHS ERR) interpolated from the Scan Line Data (SLD) field of the first ETM+ major frame reported in this file. This filed is in the range from +/- 000 to +/- 8192.	Intgr	5	SRRRR: where S = + or - RRRR is in the range from 0000 through 9999
CADU Sync Flag	Indicates if CADU sync was dropped during this scan (major frame)	Char	1	L where: L = 0 indicates no CADU sync loss L = 1 indicates CADU sync losses

Scan Sync Flag	Indicates if a real/valid sync was detected for this scan line (major frame) or not.	Char	1	S where: S = 0 indicates a real/valid sync S = 1 indicates a flywheeled sync
Scan Time Flag	Indicates if a valid timecode was received for this scan (major frame) or not.	Char	1	T where: T = 0 indicates a real/valid time code T = 1 indicates a computed timecode
Scan End of Line (EOL) Flag	Indicates if a real/valid End-of-Line (EOL) Pattern Code was detected or not.	Char	1	E where: E = 0 indicates a real/Valid EOL E = 1 indicates a flywheeled EOL
Minor Frame Fault Flag **(TBR)**	Indicates the quality of this scan by indicating the range of minor frames found missing/faulty and filled by the system. **NOTE: This flag is not currently specified in LPS design. EDC does not need it. IAS/Rich Irish likes to use this flag for IAS trending analysis.**	Char	1	N where N for a range of minor frame faults (m) is as follows: N = 0 indicates no faulty minor frames N = 1 for 1 <= m <=2 N = 2 for 3<= m <= 4 N = 3 for 5<= m <= 8 N = 4 for 9 <= m <= 16 N = 5 for 1 <= m <= 32 N = 6 for 1 <= m <= 64 N = 7 for 1 <= m <= 128 N = 8 for 1 <= m <= 256 N = 9 for 1 <= m <= 512 N = A for 1 <= m<= 1024 N = B for 1 <= m <= 2048 N = C for 1 <= m <= 4096 N = D for 1 <= m<= 8192 N = E for 1 <= m <= 12,660 (Pan Band (8) only) N = F for 1 <= m <= not defined

Computed Scan Line Length	Indicates the scan line length actually computed by the system	Intgr	5	SSSSS where the nominal line length are: SSSSS = 06330 for Bands 1, 2, 3, 4, 5, & 7 SSSSS = 03165 for Band 6 SSSSS = 12660 for Band 8 Computed line lengths may fall short or exceed these nominal.

4.1.2.3 MSCD File Format

The MSCD file format uses the HDF Vdata file structure. Details on the HDF Vdata file format are provided in Applicable Document 2.2.5.

4.1.3 Payload Correction Data File Format

4.1.3.1 PCD File Overview

Table 4-5: PCD File Format Summary

Field	Length (Bytes)	Remarks
File Descriptor		
File Record No. 1	6	
File Name	22	
File Creation Date & Time	16	
File Version No.	2	
File Source ID	12	
Total File Segments	1	
File Segment No.	1	Applicable to Band 8 file only
Software Version No.	4	
IAS Parameter Version No.	4	
Data Descriptor		
File Record No 2	6	
Spacecraft ID	8	
ETM+ Format	2	
ETM+ Sub-interval Start time	20	
ETM+ Sub-interval Stop Time	20	
Total ETM+ Scans	6	
PCD Sub-interval Start time	20	
PCD Sub-interval Stop Time	20	
Total PCD Major Frames	3	
PCD Record Length	5	
Spacecraft Orbit Number	5	

PCD Record		**The Following Fields are Repeated for each PCD Major Frame**
File Record No. 3	6	
PCD Cycle Count	2	
PCD Major Frame Count	3	
PCD Major Frame ID (0-3)	1	
Spacecraft ID - Major Frame(0)	1	
PCD Timecode - Major Frame(0)	20	
Bands Present	6	
ETM+ Last On Time	20	
ETM+ Last Off Time	20	
Full Aperture Cal. Flag	1	
Total PCD Bytes Received	8	
Total PCD Bytes Missing	8	
Total PCD Source VCDU Errors	7	
Total PCD Byte Voting Errors	7	
Total PCD MNFM Sync Errors	5	
Total PCD MNFM Counter Error	5	
Total PCD Minor Frames Filled	5	
Total PCD Major Frames Filled	3	
PCD Major Frame ID Flag	3	
PCD Timecode Flag	1	
PCD Major Frame Data	16384	One full PCD major frame consisting of a maximum of 128 minor frames, each containing 128 bytes, is provided in included in a PCD file record. No PCD bytes, used for telemetry or not, are dropped by LPS. PCD word/byte locations in a PCD cycle/major frame/ minor frame are specified in Applicable document 2.1.4. A summary of PCD byte location in the PCD cycle is provided in the appendix.

4.1.3.2 PCD File Description

Table 4-6 provides the Details on the contents of the PCD file.

Table 4-6: PCD File Format Description

Attribute (Field) Name	Attribute (Field) Name and Description	Type	Field Size (Byte)	Field Format / Valid Range / Value ($ sign indicates a blank space)
File Descriptor				
File Record No.	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000001 indicates that this is the start of the file descriptor record
File Name	Landsat 7/LPS Standard File Name **(TBR)** Note 1: The Level 0R file naming scheme described here has been review by the Landsat 7 and the ECS Projects. Additional concurrence from International Ground Station is required.	Char	22	L7XsssfnYYDOYHHuuv.xxx where: L7 indicates the Landsat 7 mission X = 1, 2 or 3 for the L7 X-band used to downlink data to the LGS sss indicates ground station source indicator, for example: sss = EDC at Sioux Falls, SD sss = ANC for Anchorage, Alaska (EDC uses 3 letter ground station name in a figure in the LPS Ops Concept) f indicates ETM+ data format: f = 1 for Format 1 data f = 2 for Format 2 data n indicates LPS processor number (1-9) YYDOYHH: indicates Landsat 7 contact period receive date, time, where: YY = Last two digit of year associated with a contact period DOY = day of year (001 through 366) associated with contact period HH = hour of the contact period within a 24 hour day (00-23) uu indicates a Sub-interval number within this contact period (00- 99) v indicates dataset version number: v = 0 for original v = 1 - 9 for reprocessed data.

File Name (contd.)				xxx indicates an LPS File type; the following file types are used in LPS: xxx = Bis for band files where: B indicates a "Band File", i indicates the :Band ID "1 through 7" for image bands 1 - 7, and "P" for the Panchromatic band 8, s indicates the file segment number s = 0 for "one segment file only", s = 1 - 4 for Pan Band file segments xxx = MSD for an MSCD file xxx = PCD for a PCD file xxx = CAL for a Calibration File xxx = MTA for a Metadata File xxx = Rnn for Multi-Browse File where nn (01-99) indicates the WRS scene number identified in the metadata file.
File Creation Date & Time	LPS system date and time when this file was created. This time may vary from file to file within the same Level 0R file set. Note: The time format in CAPITAL letters indicates LPS/Local system generated time.	Time	16	$YY:DDD:HH:MM:SS where: YY: Julian Year (00 through 99) DDD: Day (01 through 366) HH: hours (00 through 23) MM: minutes (00 through 59) SS: seconds (00 through 59) The time is in the range from 00:001:00:00:00 to 99:365:23:59:59
File Version No.	Reprocessing indicator to distinguish this file from the Level 0R file generated earlier for the same sub-interval and provided to the LP DAAC. The reprocessing information may be tracked by LPS or entered by an operator during setup of the reprocess operation. **(TBR)**	Char	2	$R: where $ indicates a "blank space" R = 0 indicates "not a reprocessed file" R = 1 through 9" indicates the file reprocess count value

File Source ID	This field identifies the country, responsible agency and the source system which created this file.	Char	12	CCCAAAAASSSn where: CCC indicates country name such as USA AAAAA indicates responsible agency such as "NOAA" in the case of LPS. SSS indicates the source ground station (e.g. EDC) and or a system such as the LPS. n indicates the source system string number (1 to 9) which generated the file
Total File Segments	This fields indicates the total number segments making this file is segmented. This field is used to indicate LPS Band 8 file segments.	Intgr	1	S = 0 indicates that this file is a single file with no segments. S = 1 -4 indicates the total number of segments making this file.
File Segment No.	Applicable only to the LPS Panchromatic (Band 8) file. This field allows LPS to segment a Band 8 subinterval into smaller segments to overcome system/data storage and transfer limitations.	Intgr	1	N = 0 indicates that this file is a single file with no segments. N = 1 - 4 indicates the file segment number for this file. LPS allows from 1 to 4 segments for its Band 8 (Panchromatic Band) file.
Software Version No.	Version number of the software on the source system when this file was created.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
IAS Parameter Version No.	The version No. of the IAS Parameter file used in generating this file.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
Data Descriptor				
File Record Number	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000002 indicates the data descriptor record

Spacecraft ID	Spacecraft identification as reported in the SCID field (bits 2 through 9) of the first valid CADU of the first ETM+ (scan) reported in this file. A valid CADU/VCDU has no errors.	Char	8	Landsat7
ETM+ Format	This field identifies the ETM+ Format ,1 or 2, applicable for providing an allowable band data in this file. The ETM+ format information is extracted from the PCD/Status data field of the first valid VCDU of the first major frame of the sub-interval reported in this file. A valid VCDU has no errors.	Char	2	Fn where: Fn = F1 for ETM+ Format 1 data Fn = F2 for ETM+ Format 2 data
Sub-interval Spacecraft Start Time	The spacecraft time extracted from the timecode minor frames of the first ETM+ major frame of the sub-interval reported in this file. (Note: The year information (Capitalized) is appended by LPS to the ETM+ timecode format.)	Time	20	$YY:ddd:hh:mm:ss.ttt with a range YY: Last two digits of Julian Year ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) The time is in the range from: 00:001:00:00:00.000 through 99:366:23:59:59.999
Sub-interval Spacecraft Stop Time	The spacecraft time extracted from the timecode minor frames of the last ETM+ major frame of the sub-interval reported in this file.	Char	20	$YY:ddd:hh:mm:ss.ttt with a range YY: Last two digits of Julian Year ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) The time is in the range from: 00:001:00:00:00.000 through 99:366:23:59:59.999

Total ETM+ Scans (S)	The total number of ETM+ scans reported in this subinterval file. A maximum of 13,125 scans can be received in a 14 minute subinterval (based on a maximum of 35 scenes, each consisting of at most 375 scans)	Intgr	6	SSSSSS in the range of 000325 to 13,125
PCD Sub-interval Start Time	Indicates spacecraft time of the first major frame of the first full PCD cycle included in this file for an ETM+ sub-interval. The PCD source data bytes are identified in the PCD locator tables provided in the appendix.	Char	20	$ddd:hh:mm:ss.ttt:ff with a range from 001:00:00:00.000:00 through 366:23:59:59.999.15 where: ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) ff: Sixteenths of a millisecond (00 through 15)
PCD Sub-interval Stop Time	Indicates spacecraft time of the first major frame of the first full PCD cycle included in this file for an ETM+ sub-interval. The PCD source data bytes are identified in the PCD locator tables provided in the appendix.	Char	20	$ddd:hh:mm:ss.ttt:ff with a range from 001:00:00:00.000:00 through 366:23:59:59.999.15 where: ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) ff: Sixteenths of a millisecond (00 through 15)
Total PCD Major Frames	Total Number of PCD Major Frames present in this PCD file for this sub-interval. Approximately 212 major frames can be received by the LPS during a 14.1 minute long sub-interval.	Intgr	3	MMM: in the range from 000 through 999
PCD Record Length	Data from each PCD major frame is reported in a fixed length record in this file.	Intgr	5	Each PCD record has a fixed length of 13,600 (13,384 + 216) Bytes .
Spacecraft Orbit Number	Landsat 7 orbit number, since spacecraft launch, is calculated by LPS. Approximately 26591 orbits are possible during a 5 year mission period.	Intgr	6	BBBBBB: where BBBBBB: 00001 through 99999

PCD Record	The following Fields of a PCD Record are Repeated for each PCD MJFM			
File Record No.	This field contains a sequence number for this record in this file. This number is "3" for the first PCD record. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ in the range from 000000 to 000999
PCD Cycle Count	This field indicates the PCD Cycle number for the current record in the PCD file. A PCD cycle consists of 4 consecutive PCD major frames. This number is incremented by 1 for every fourth PCD major frame received during an ETM+ sub-interval. This number can be as high as 53 for a 14 minute long sub-interval.	Intgr	2	CC: in the range from 00 to 99
PCD Major Frame Count	The field contains a sequence number for the PCD major frame received in a sub-interval and reported in this record of the file. The PCD major frame number is incremented by one for each new PCD major frame added to the sub-interval reported in this file. This number can be as high as 212 for a maximum size sub-interval of 14 minutes. (PCD major frame time = 4.096 seconds)	Intgr	3	SSS where: SSS is in the rages from 001 to 999
PCD Major Frame ID (0-3)	A PCD major frame ID is determined based on the information contained in the PCD words associated with the current PCD major frame. These PCD words are identified in the PCD locator Table included in appendix.	Intgr	1	M: 0 -3 M cycles from 0 through 3 on major frame basis within each complete PCD cycle.
Spacecraft ID - Major Frame(0)	This field provides the Landsat 7 spacecraft identification extracted from PCD Major Frame (0). Refer to the PCD locator table provided in the appendix for the spacecraft ID location information.	Char	1	L = 7 The Spacecraft ID is repeated in all PCD records even though it is received in PCD Major Frame (0) only.

PCD Timecode - Major Frame(0)	This field provides the spacecraft time extracted from PCD Major frame (0) of each PCD cycle. The PCD source data bytes are identified in the PCD locator tables provided in the appendix. The Spacecraft timecode is interpolated for PCD records associated with PCD Major Frames 1,2 and 3 of each PCD cycle.	Char	20	$ddd:hh:mm:ss.ttt:ff with a range from 001:00:00:00.000:00 through 366:23:59:59.999.15 where: ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) ff: Sixteenths of a millisecond (00 through 15)
Bands Present	This information is extracted from the third PCD major frame, minor frame 32, word 72, bits 0 through 6. All bands present for either Format 1 or Format 2 are shown by their respective band numbers. A missing band is indicated by a "-" in its respective position.	Char	6	nnnnnn: where: nnnnnn: 123456 for Format 1 data OR nnnnnn: 678$$$ for Format 2 data; A missing band is shown by a "-" Band 8 is the Pan band.
ETM+ Last On Time	This field is as defined in the Landsat 7 DFCB. See PCD locator table in the appendix for locating this information in a PCD major frame. This information is in a 48-bit extended precision floating point value in seconds from midnight of the first day of the current year. A maximum of 31,622,400 seconds are possible in a year.	Time	20	$ddd:hh:mm:ss.ttt:ff with a range from 001:00:00:00.000:00 through 366:23:59:59.999.15 (ee format details above) Note: The PCD extracted time is in floating point format S39.8 where: S is the sign bit 39 indicates a 39 bit mantissa, and 8 indicates an 8 bit exponent. It needs to be converted to time format.
ETM+ Last Off Time	This field is as defined in the Landsat 7 DFCB. See PCD locator table in the appendix for locating this information in a PCD major frame. This information is in a 48-bit extended precision floating point value in seconds from midnight of the first day of the current year. A maximum of 31,622,400 seconds are possible in a year.	Time	20	$ddd:hh:mm:ss.ttt:ff with a range from 001:00:00:00.000:00 through 366:23:59:59.999.15 (ee format details above)

Full Aperture Cal. Flag	This field indicates the ETM+ Calibration Activity Status. The calibration door activity status is interpolated from "serial word P of the third PCD major frame, minor frame 83, word 72, bits 2 and 3.	Char	1	D: 0 or 1 0: indicates no calibration door activity 1: indicates calibration door activity
Total PCD Bytes Received	Indicates the total number of PCD bytes received by LPS in VCDUs. This number could be as high as 30,504,804.	Intgr	8	PPPPPPPP: in the range from 00000000 through 99999999
Total PCD Bytes Missing	Indicates the total number of PCD bytes identified missing due to missing VCDUs. This number could be as high as 30,504,804.	Intgr	8	MMMMMMMM: in the range from 00000000 through 99999999
Total PCD Source VCDU Errors	Indicates the total number of PCD source VCDUs flagged by LPS as containing errors (questionable quality). This number could be as high as 7,626,201 VCDUs for a single sub-interval.	Intgr	7	EEEEEEE: in the range from 0000000 through 9999999
Total PCD Byte Voting Errors	Indicates the total number of unpacked PCD bytes which contained voting error. This number could be as high as 3,389,422.	Intgr	7	VVVVVVV: in the range from 0000000 through 9999999
Total PCD Minor Frame Sync Errors	Indicates the number of PCD minor frames containing an erroneous sync word. A maximum of 27136 minor frame count is possible.	Intgr	5	SSSSS: in the range from 00000 through 99999
Total PCD Minor Frame Count Errors	Indicates the number of PCD minor frames received with incorrect minor frame counter values. A maximum of 27136 minor frame count is possible.	Intgr	5	CCCCC: in the range from 00000 through 99999
Total PCD Minor Frames Filled	Indicates the total number of PCD minor frames which contained erroneous values in word fields and were filled with a known value by LPS.		5	FFFFF: in the range from 00000 through 99999

Total PCD Major Frames Filled	The total number of PCD major frames which required a data fill during their construction. Approximately 212 major frames can be received by the LPS during a 14.1 minute long sub-interval.	Intgr	3	MMM: in the range from 0000 through 999
PCD Major Frame ID Flag	Indicates the number of PCD major frames received with incorrect ID values. A maximum of 212 major frames are possible during a 14 minute long sub-interval.	Intgr	3	EEE: in the range from 000 through 999
PCD Timecode Flag	Determined by LPS		1	T: where T = 0 indicates good PCD timecode T= 1 indicates that the PCD timecode is in error.
PCD Major Frame Data	A raw PCD major frame consisting of minor frames 0 - 127 is provided in this field.		16384	128 Bytes per minor frame X 128 minor frames per Major Frame

4.1.3.3 PCD File Format

The PCD file format uses the HDF Vdata structure defined in Applicable document 2.1.5.

4.1.4 Calibration Data File

4.1.4.1 Calibration File Overview

Figures 4-2 and and 4-3 and Table 4-7 provide an overview of the Calibration file. The calibration file contains data from all bands from a single subinterval. The calibration data is organized in band sequential order, as shown in Figure 4-2, in the Cal. file. The calibration file for a Format 1 subinterval contains data from bands 1 - 6, while the calibration file for a Format 2 subinterval contains data from Band 6 - 8. Each record in the calibration file contains an entire band-detector Cal. data line pas the End-of-Line Code in a ETM+ scan (major frame).

The following sizing assumptions are used to define the range of values included in the calibration file:

1. Scans per Scene:
   - Minimum: 325
   - Average: 350
   - Maximum: 375

2. Cal. Data Lines per Scene:
   - Bands 1 - 5 and 7: 350 x 16 = 5600 (Average)
   - Band 6: 325 x 8 = 2600 (Minimum)
   - Band 8: 375 x 32 = 12000 (Maximum)

3. Subinterval Duration: 14 minutes
   (The longest possible contact period duration - worstcase)

4. Scene Duration: ~ 24 seconds
5. Number of Scenes per Subinterval: ~ 35
   (The longest possible contact period with a single subinterval)

6. ETM+ Scans per Subinterval:
   Minimum: 325 x 35 = 11,375
   Average: 350 x 35 = 12,250
   Maximum: 375 x 35 = 13,125

7. Cal. Data Lines per Subinterval:
   - Bands 1 - 5 and 7: 5600 x 35 = 196,000 (Average)
   - Band 6: 2600 x 35 = 91,000 (Minimum)
   - Band 8: 12000 x 35 = 420,000(Maximum - all 4 file segments)

8. Cal Data Line Lengths:
   - Band 1 - 5 and 7: 6313 Bytes (minor frames, average)
   - Band 6: 6313 / 2 = ~ 3157 Bytes

- Band 8: 6313 x 2 = 12,626 Bytes

9. Subinterval Sizes:
   - Band 1 - 5 and 7: 196,000 x 960 = ~ 188.16 MB
   - Band 6: 91,000 x 480 = 43.68 MB
   - Band 8: 420,000 x 1,920 = ~ 806.4 MB

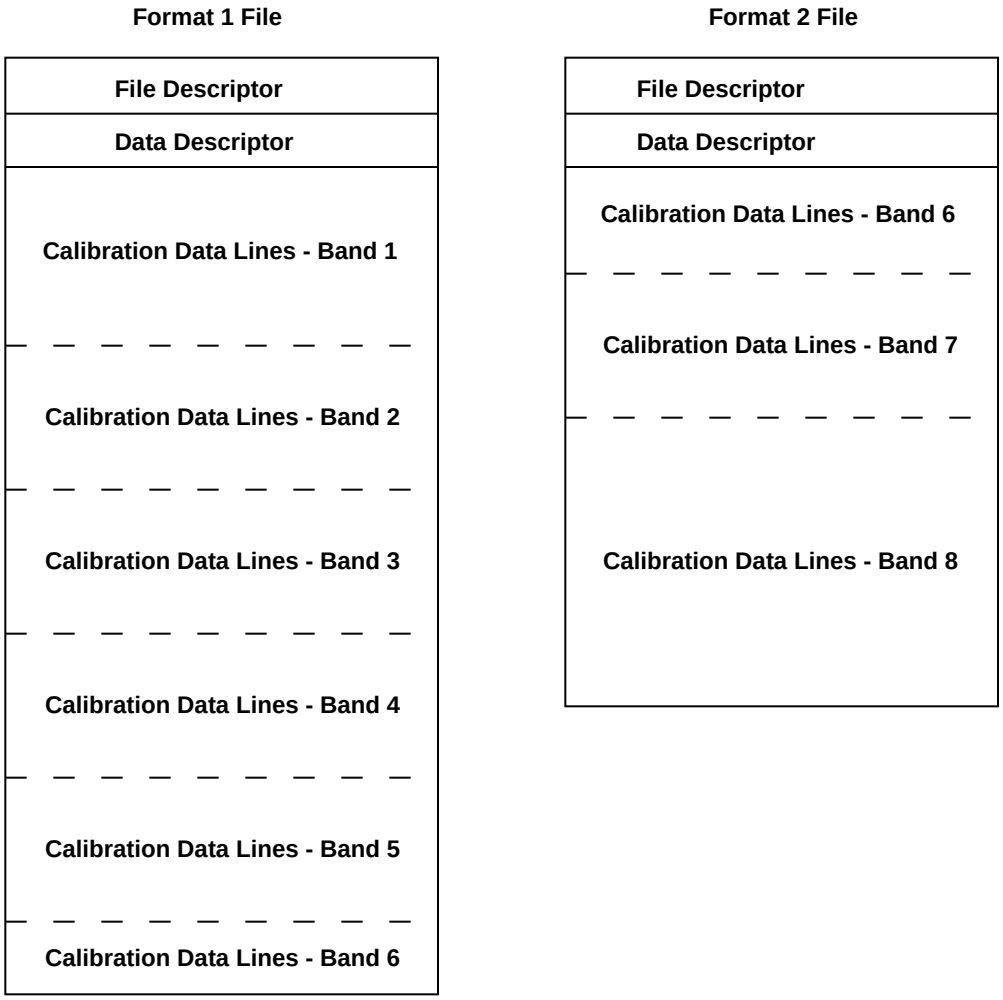

Figure 4-2: Calibration Data File Overview

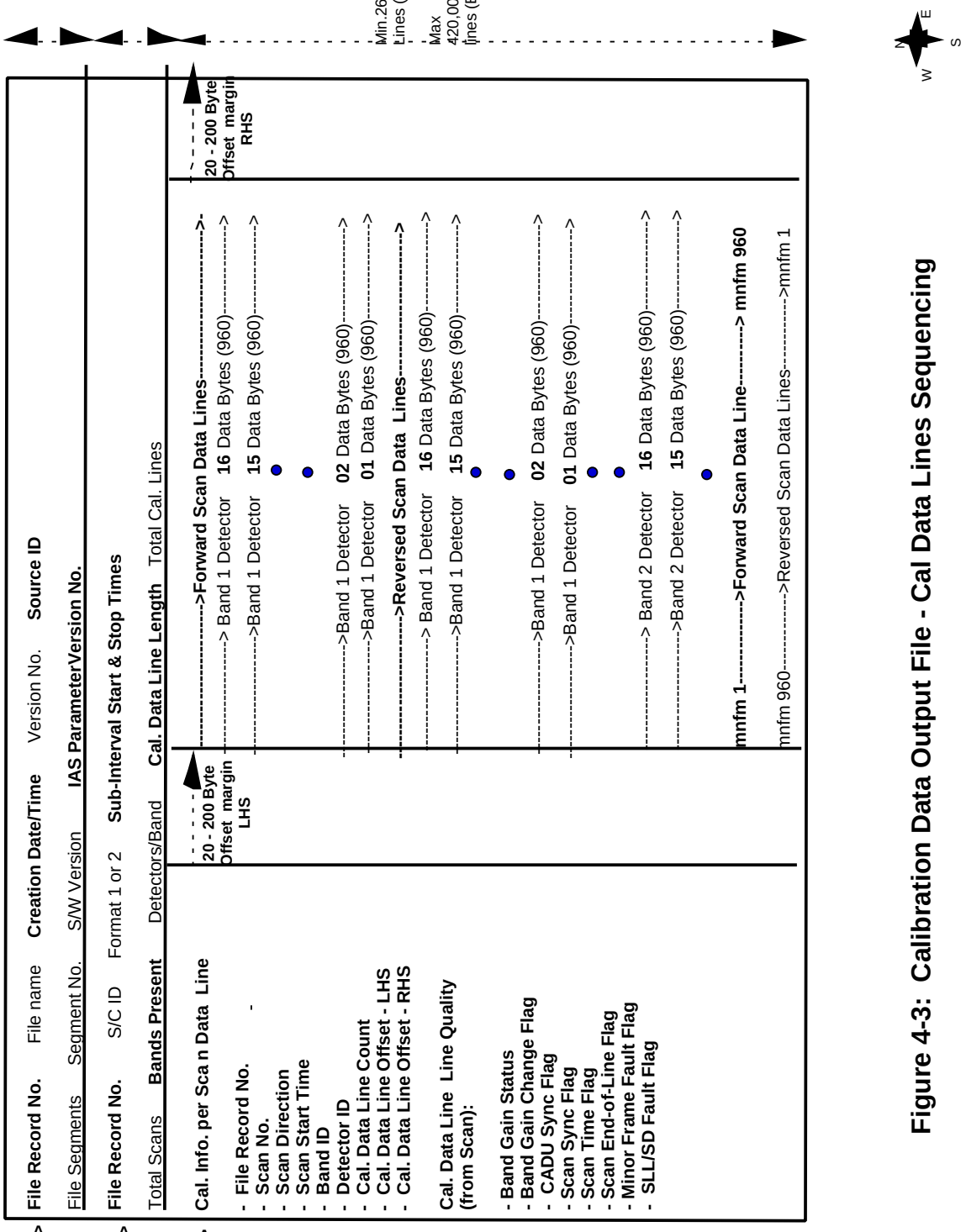

Figure 4-3: Calibration Data Output File - Cal Data Lines Sequencing

Table 4-7: Calibration File Format Summary

Field	Length (Bytes)	Remarks
File Descriptor		
File Record No. 1	6	
File Name	22	
File Creation Date & Time	16	
File Version No.	2	
File Source ID	12	
Total File Segments	1	
File Segment No.	1	Applicable to Band 8 file only
Software Version No.	4	
IAS Parameter Version No.	4	
Data Descriptor		
File Record No. 2	6	
Spacecraft ID	8	
ETM+ Format	2	
Sub-interval start time	20	
Sub-interval stop time	20	
Total Scans	6	in this subinterval
Bands Present	6	
Detectors per Band (d)	6	
Cal. Data Line Length	4	Line length for majority of Cal data lines
Total Cal. Data Lines	6	-- in this subinterval
Data Records		**The following fields are repeated for each Band-Detector Cal. Data Line in the subinterval**
File Record No. 3	6	
Scan Number N	6	where: 325 < N < 375 (Average: 350 scans)
Scan Direction	2	
Scan start time	22	

Band ID	2	
Detector ID	2	
Cal. Data Line Count (L)	6	where: 325xM < L < 375 x d Average L: 350 x d
Cal. Data Line Offset - LHS	4	
Cal. Data Line Offset - RHS	4	
Band Gain Flag	1	**Scan Quality Info. by Cal . Data Lines**
Band Gain Change Flag	1	/
CADU Sync Flag	1	/
Scan Sync Flag	1	/
Scan Time Flag	1	/
Scan End-of-Line (EOL) Flag	1	/
Minor Frame Fault Flag	1	/
SLL/SD Fault Flag	1	/
Cal. Data Line (Pixel Data)		**Cal. Data Line - Band-Detector Pixels**

4.1.4.2 Calibration File Description

Table 4-8 provides details on the contents of the Calibration file.

Table 4-8: Calibration File Format Description

Attribute (Field) Name	Attribute (Field) Name and Description	Type	Field Size (Byte)	Field Format / Valid Range / Value ($ sign indicates a blank space)
File Descriptor				
File Record No.	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000001 indicates that this is the start of the file descriptor record
File Name	Landsat 7/LPS Standard File Name **(TBR)** Note 1: The Level 0R file naming scheme described here has been review by the Landsat 7 and the ECS Projects. Additional concurrence from International Ground Station is required.	Char	22	L7XsssfnYYDOYHHuuv.xxx where: L7 indicates the Landsat 7 mission X = 1, 2 or 3 for the L7 X-band used to downlink data to the LGS sss indicates ground station source indicator, for example: sss = EDC at Sioux Falls, SD sss = ANC for Anchorage, Alaska (EDC uses 3 letter ground station name in a figure in the LPS Ops Concept) f indicates ETM+ data format: f = 1 for Format 1 data f = 2 for Format 2 data n indicates LPS processor number (1-9) YYDOYHH: indicates Landsat 7 contact period receive date, time, where: YY = Last two digit of year associated with a contact period DOY = day of year (001 through 366) associated with contact period HH = hour of the contact period within a 24 hour day (00-23) uu indicates a Sub-interval number within this contact period (00- 99) v indicates dataset version number: v = 0 for original v = 1 - 9 for reprocessed data.

File Name (contd.)				xxx indicates an LPS File type; the following file types are used in LPS: xxx = Bis for band files where: B indicates a "Band File", i indicates the :Band ID "1 through 7" for image bands 1 - 7, and "P" for the Panchromatic band 8, s indicates the file segment number s = 0 for "one segment file only", s = 1 - 4 for Pan Band file segments xxx = MSD for an MSCD file xxx = PCD for a PCD file xxx = CAL for a Calibration File xxx = MTA for a Metadata File xxx = Rnn for Multi-Browse File where nn (01-99) indicates the WRS scene number identified in the metadata file.
File Creation Date & Time	LPS system date and time when this file was created. This time may vary from file to file within the same Level 0R file set. Note: The time format in CAPITAL letters indicates LPS/Local system generated time.	Time	16	$YY:DDD:HH:MM:SS where: YY: Julian Year (00 through 99) DDD: Day (01 through 366) HH: hours (00 through 23) MM: minutes (00 through 59) SS: seconds (00 through 59) The time is in the range from 00:001:00:00:00 to 99:365:23:59:59
File Version No.	Reprocessing indicator to distinguish this file from the Level 0R file generated earlier for the same sub-interval and provided to the LP DAAC. The reprocessing information may be tracked by LPS or entered by an operator during setup of the reprocess operation. **(TBR)**	Char	2	$R: where $ indicates a "blank space" R = 0 indicates "not a reprocessed file" R = 1 through 9" indicates the file reprocess count value

File Source ID	This field identifies the country, responsible agency and the source system which created this file.	Char	12	CCCAAAAASSSn where: CCC indicates country name such as USA AAAAA indicates responsible agency such as "NOAA" in the case of LPS. SSS indicates the source ground station (e.g. EDC) and or a system such as the LPS. n indicates the source system string number (1 to 9) which generated the file
Total File Segments	This fields indicates the total number segments making this file is segmented. This field is used to indicate LPS Band 8 file segments.	Intgr	1	S = 0 indicates that this file is a single file with no segments. S = 1 -4 indicates the total number of segments making this file.
File Segment No.	Applicable only to the LPS Panchromatic (Band 8) file. This field allows LPS to segment a Band 8 subinterval into smaller segments to overcome system/data storage and transfer limitations.	Intgr	1	N = 0 indicates that this file is a single file with no segments. N = 1 - 4 indicates the file segment number for this file. LPS allows from 1 to 4 segments for its Band 8 (Panchromatic Band) file.
Software Version No.	Version number of the software on the source system when this file was created.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
IAS Parameter Version No.	The version No. of the IAS Parameter file used in generating this file.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
Data Descriptor				
File Record No.	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000002 indicates the data descriptor record

Spacecraft Identification	Spacecraft identification as reported in the SCID field (bits 2 through 9) of the first valid CADU of the first ETM+ (scan) reported in this file. A valid CADU/VCDU has no errors.	Char	8	Landsat7
ETM+ Format	This field identifies the ETM+ Format 1 or 2, applicable for providing an allowable band data in this file. The ETM+ format information is extracted from the PCD/Status data field of the first valid VCDU of the first major frame of the sub-interval reported in this file. A valid VCDU has no errors.	Char	2	Fn where: Fn = F1 for ETM+ Format 1 data Fn = F2 for ETM+ Format 2 data
Sub-interval Spacecraft Start Time	The spacecraft time extracted from the timecode minor frames of the first ETM+ major frame of the sub-interval reported in this file. (Note: The year information (Capitalized) is appended by LPS to the ETM+ timecode format.)	Time	20	$YY:ddd:hh:mm:ss.ttt with a range YY: Last two digits of Julian Year ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) The time is in the range from: 00:001:00:00:00.000 through 99:366:23:59:59.999
Sub-interval Spacecraft Stop Time	The spacecraft time extracted from the timecode minor frames of the last ETM+ major frame of the sub-interval reported in this file.	Char	20	$YY:ddd:hh:mm:ss.ttt with a range YY: Last two digits of Julian Year ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) The time is in the range from: 00:001:00:00:00.000 through 99:366:23:59:59.999

Total Scans (S)	The total number of ETM+ scans reported in this subinterval file. A maximum of 13,125 scans can be received in a 14 minute subinterval (based on a maximum of 35 scenes, each consisting of at most 375 scans)	Intgr	6	SSSSSS in the range of 000325 to 13,125
Bands Present	This information is extracted from the third PCD major frame, minor frame 32, word 72, bits 0 through 6. All bands present in either Format 1 or Format 2 data are shown by their respective band numbers. A missing band is indicated by a "-" in its respective position.	Char	6	nnnnnn: where: nnnnnn: 123456 indicates that all bands in Format 1 data are present OR nnnnnn: 678$$$ indicates that all bands in Format 2 data are present A missing band is shown by a "-" Band 8 is the Pan band.
Detectors per Band (d)	This field indicates the total number of detectors associated with various bands reported in this file.	Char	6	BBSSPP where: BB = 16 (detectors) for Bands 1, 2, 3, 4, 5, and 7 SS = 8 (detectors) for Band 6 PP = 32 (detectors) for Band 8
Cal. Data Line Length (n)	A Cal. data line is formed by assembling data from one of the many detectors of a band past the EOL in an ETM+ scan (major frame). The nominal Cal. data line length (in bytes) depends on the ETM+ band selected for this file. There are a nominal of 960 minor frames. The nominal number of minor frames in a major frame (scan) may increase due to bumper wear over years. This requires that the scan line length field should be able to accept 17 additional minor frames for each of Bands 1 -5 & 7 to account for this bumper wear. Scan line sizes are also adjusted by 9 and 34 minor frames (bytes) for Bands 6 and 8, respectively.	Intgr	4	nnnn where, nominally: nnnnnn = 0977 for Bands 1 to 5 and 7 nnnnn = 0489 for Band 6 (either Format 1 or Format 2) nnnnn = 1954 for Band 8 (Pan)

Total Cal. Data Lines (k) - Bn	The actual number of Cal. data lines collected in this subinterval file are calculated as follows: B1, 2, 3, 4, 5, or 7: Total scans * 16 B6: Total scans(s) * 8 B8: Total scans * 32	Intgr	6	kkkkkk in the range from: 002600 for Band 6 for the smallest sub-interval period (1 scene with a minimum of 325 scans) to 210,000 for Band 6 for the longest sub-interval (35 scenes each consisting of a maximum of 375 scans
Data Records				
File Record No.	This field contains a sequence number for this data record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ in the range from 000003 to 012000 QQQQQQ = 3 indicates the first data record in this band file.
Scan Number N	The field provides a sequence count for the ETM+ scans (major frame) reported in the sub-interval . The ETM+ scan counter is incremented by one for each new scan, real or flywheeled, added to the sub-interval. This number can be as high as 13,125 for a 14 minute long sub-interval.	Intgr	6	SSSSSS where: SSSSSS is in the rages from 000325 to 013125
Scan Direction	The ETM+ scan direction information interpolated from the Scan Line Data (SLD) minor frames of the first ETM+ major frame reported in this file.	Char	2	D$: where D = "F" for a Forward received scan D = "R" for a Reverse received scan
Scan Start Time	Indicates the ETM+ scan start time extracted from the time code minor frames of the ETM+ major frame reported in this data record. A computed scan start time is provided if valid time not available from the time code minor frames.	Time	22	YY:ddd:hh:mm:ss.ttt:ff with a range from 00:001:00:00:00.000:00 through 99:366:23:59:59.999.15 where: YY: Last two digits of Julian Year DDD: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) ff: Sixteenths of a millisecond (00 through 15)

Band ID	This field identifies the ETM+ band associated with the current Cal. Data Line (included in this record).	Char	2	Bn where B is a prefix for band ID, and n = 1, 2,3, 4, 5, 6, 7, or P (Band 8)
Detector ID	This field identifies the detector of the band used in forming and providing the current Cal Data Line (reported in this record). Cal. data from each detector of a band is reported once during an ETM+ scan, forward and reverse. The reporting detector sequence count increases for an ascending orbit and decreases for a descending orbit. **TBR: Do we know orbit condition here? Does it matter which detector order the data is organized, as long as the detector order is maintained throughout an interval?**	Intgr	2	dd where: dd= A single detector number in the range from 01 to 32 Band 1 - 5 & 7: Max. 16 detectors Band 6: Max. 8 detectors Band 8: Max. 32 detectors The selected detector number is incremented (or decremented) for each new scan line (see also the Band File overview Figure)
Cal. Data Line Count (L)	**The Cal Data Line Count is incremented for each Band-Detector line added to the subinterval Cal. file. This counter is incremented once per ETM+ scan for Bands 1 - 5 and 7, once every two ETM+ scans for Band 6, and twice for each ETM+ scan for Band 8.**	Intgr	6	SSSSSS where: SSSSSS is in the rages from 002600 (Band 6 of 1 scene) to 420,000 (Band 8 of 35 scenes)
Cal. Data Line Offset - LHS **(TBR)**	The Cal. line data in each record of the band file is initially written with a predetermined size of byte off-set on the left and right of the designated scan line data area. These offsets are provided to accommodate Cal. line length growth due to ETM+ scanner bumper wear. Later, during band-detector alignment, these offsets are adjusted (without any data loss) to provide the valid start and stop bytes/pixel positions for the scan line contained in this field. (See also Band File overview figure).	Char	4	LTTT where: L denotes the LHS offset TTT: number of bytes in the range from 00 to 200 **(TBR)** The scan line data offset is initially set to 20 bytes filled with the value "0" Detector-band pixel alignment may increase this offset to a maximum of 194 bytes. **(TBR)**

Cal. Data Line Offset - RHS **(TBR)**	Same as for "Scan Line Margin - Left Hand Side"	Char	4	RTTT where: R denotes the RHS offset, TTT: number of bytes in the range from 00 to 200 **(TBR)** The scan line data offset is initially set to 20 bytes filled with the value "0" Detector-band pixel alignment may increase this offset to a maximum of 194 bytes. **(TBR)**
Band Gain Flag	The band gain information is extracted from the first PCD/status data field of the first valid VCDU used in construction of the ETM+ major frame corresponding to this scan data line.	Char	1	G where: G = L indicates a "low gain", and G = H indicates a "high gain"
Band Gain Change Flag	Indicates the change in band gain during this scan line.	Char	1	C where: C = 0 indicates no change in band gain for this line C = 1 indicates a change in band gain for this line.
CADU Sync Flag	Indicates if CADU sync was dropped during this scan (major frame)	Char	1	L where: L = 0 indicates no CADU sync loss L = 1 indicates CADU sync losses
Scan Sync Flag	Indicates if a real/valid sync was detected for this scan line (major frame) or not.	Char	1	S where: S = 0 indicates a real/valid sync S = 1 indicates a flywheeled sync
Scan Time Flag	Indicates if a valid timecode was received for this scan (major frame) or not.	Char	1	T where: T = 0 indicates a real/valid time code T = 1 indicates a computed timecode
Scan End of Line (EOL) Flag	Indicates if a real/valid End-of-Line (EOL) Pattern Code was detected or not.	Char	1	E where: E = 0 indicates a real/Valid EOL E = 1 indicates a flywheeled EOL

Minor Frame Fault Flag **(TBR)**	Indicates the quality of this scan by indicating the range of minor frames found missing/faulty and filled by the system. **NOTE: This flag is not currently specified in LPS design. EDC does not need it. IAS/Rich Irish likes to use this flag for IAS trending analysis.**	Char	1	N where N for a range of minor frame faults (m) is as follows: N = 0 indicates no faulty minor frames N = 1 for 1 <= m <=2 N = 2 for 3<= m <= 4 N = 3 for 5<= m <= 8 N = 4 for 9 <= m <= 16 N = 5 for 1 <= m <= 32 N = 6 for 1 <= m <= 64 N = 7 for 1 <= m <= 128 N = 8 for 1 <= m <= 256 N = 9 for 1 <= m <= 512 N = A for 1 <= m<= 1024 N = B for 1 <= m <= 2048 N = C for 1 <= m <= 4096 N = D for 1 <= m<= 8192 N = E for 1 <= m <= 12,660 (Pan Band (8) only) N = F for 1 <= m <= not defined
SLL/SD Fault Flag	Indicates if a real/valid Scan Line Length/Scan Direction word was detected or not.	Char	1	S where: S = 0 indicates a real/Valid EOL S = 1 indicates a flywheeled EOL
Cal. Data Line (Data Pixels)	This field contains all data bytes, valid or not, collected from a single detector of the selected band to form a cal. line. The cal. line LHS and RHS offsets indicate the actual start and end of a valid scan line after pixel alignment. Due to Band-detector pixel alignment, the valid line length may decrease by up to 194 pixels for each band type.	Binary	489 - 1954	Data Bytes 1 through n where: n = 977 for Bands 1, 2, 3, 4, 5 or 7 or **n = 489 for Band 6 or** n = 1954 for Band 8 Nominal values for n are shown. Band-detector alignment may decrease the nominal value of n by a maximum of 194 bytes for each band type. All data bytes are 8-bit binary words with a value in the range from 0 to 255.

4.1.4.3 Calibration File Format

Calibration data files are stored in LPS and transferred to the LP DAAC in the HDF Swath format. Guidelines for converting the LPS Calibration data output files to the HDF Swath format are provided in **Applicable Document 2.1.6.**

4.2 Metadata File Format

4.2.1 Metadata File Overview

An content over view of the metadata file is provided in Table 4-9.

Table 4-9: Metadata File Format Summary

Field	Length (Bytes)	Remarks
File Descriptor		
File Record No. 1	6	
File Name	22	
File Creation Date & Time	16	
File Version No.	2	
File Source ID	12	
Total File Segments	1	
File Segment No.	1	Applicable to Band 8 file only
Software Version No.	4	
IAS Parameter Version No.	4	
Sub-Total A:		
Data Descriptor		**Sub-Interval level Metadata Record The following Fields are repeated once in this File for the entire subinterval.**
File Record No 2	6	
Spacecraft ID	8	
ETM+ Format	2	
Contact Period Start Time	16	
Contact Period Stop Time	16	
Orbit Number:	6	
WRS Path:	3	

Starting Row	3	
Ending Row	3	
Sub-interval start time	18	First ETM+ Scan Time
Sub-interval stop time	18	Last ETM+ Scan Time
Total ETM+ Scans:	8	
PCD Start Time	16	First PCD Major Frame Time
PCD Stop Time	16	Last PCD Major Frame Time
Total PCD Major Frames	4	
ETM+ Last On Time	20	
ETM+ Last Off Time	20	
Bands Present	6	
Total WRS Scenes	2	
Band 1/6 File Name	22	Band 6 File Name, if Format 2
Band 2/7 File Name	22	Band 7 File Name, if Format 2
Band 3/8 File Name	22	Band 8 File Name, if Format 2
Band 4 File Name	22	No File Name/Filed, if Format 2
Band 5 File Name	22	No File Name/Field, if Format 2
Band 6 File Name	22	No File Name/Field, if Format 2
MSCD File Name	22	
PCD File Name	22	
Calibration File Name	22	
Browse File Name(s)	22 x 35	Repeated for each WRS Scenes in a Subinterval - Up to 35 Scenes are possible
Scene Metadata Records		**The following Fields are repeated for each WRS Scene Reported in this File.**
File Record Number	6	Up to 999 records are allowed
WRS Scene Number	3	
WRS Path	3	
WRS Row	3	
Scene Center Scan Number	6	
Scene Center Scan Time	18	
Scene Center Latitude	16	Nominal from WRS Map
Scene Center Longitude	16	Nominal from WRS Map
Horizontal Display Shift	4	Calculated value

Upper Left Corner Latitude	16	Nominal Value (TBR)
Upper Left Corner Longitude	16	"
Upper Right Corner Latitude	16	"
Upper Right Corner Longitude	16	"
Lower Left Corner Latitude	16	"
Lower Left Corner Longitude	16	"
Lower Right Corner Latitude	16	"
Lower Right Corner Longitude	16	"
Scene CCA	3	Format 1 only
Quad 1 CCA	3	"
Quad 2 CCA	3	"
Quad 3 CCA	3	"
Quad 4 CCA	3	"
ACCA Algorithm ID	12	**TBR**
Sun Azimuth Angle	12	
Sun Elevation Angle	12	
Band Gains	6	Format 1 or Format 2
Band Gain Changes	6	Format 1 or Format 2
Full Aperture Cal. Activity Flag	1	
Partial Aperture Cal. Flag	1	Day/Night Flag
ETM+ Q&A		WRS Scene-based Q&A
CADUs/VCDUs Received	8	
Flywheeled CADUs	4	
R-S Error VCDUs	4	
BCH Corrected VCDUs	4	
BCH Uncorrected VCDUs	4	
Bit Error Rate	4	
ETM+ Timecode Errors	4	
Entirely Filled Scans	4	
Partially Filled Scans	4	
PCD Q&A		WRS Scene-based Q&A
PCD Words Received	8	

PCD Byte Voting Errors	4	
Total PCD Minor Frames	6	
PCD Minor Frame Errors	4	
Filled PCD Minor Frames	4	
Filled PCD Major Frames	4	
Processed PCD Q&A		WRS Scene-based Q&A
Attitude Data Points	4	
Rejected Attitude Data Points	4	
Missing Attitude Data Points	4	
Ephemeris Data Points	4	
Rejected Ephemeris Data Points	4	
Missing Ephemeris Data Points	4	
WRS Scene Calculation Errors	2	**TBR**
Sub-Total B:		
Sub-Total C:		

4.2.2 Metadata File Description

Details on the Level 0R metadata file are provided in Table 4-10.

Table 4-10: Metadata File Format Description

Attribute (Field) Name	Attribute (Field) Name and Description	Type	Field Size (Byte)	Field Format / Valid Range / Value ($ sign indicates a blank space)
File Descriptor				
File Record Number	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000001 indicates that this is the start of the file descriptor record
File Name	Landsat 7/LPS Standard File Name **(TBR)** Note 1: The Level 0R file naming scheme described here has been review by the Landsat 7 and the ECS Projects. Additional concurrence from International Ground Station is required.	Char	22	L7XsssfnYYDOYHHuuv.xxx where: L7 indicates the Landsat 7 mission X = 1, 2 or 3 for the L7 X-band used to downlink data to the LGS sss indicates ground station source indicator, for example: sss = EDC at Sioux Falls, SD sss = ANC for Anchorage, Alaska (EDC uses 3 letter ground station name in a figure in the LPS Ops Concept) f indicates ETM+ data format: f = 1 for Format 1 data f = 2 for Format 2 data n indicates LPS processor number (1-9) YYDOYHH: indicates Landsat 7 contact period receive date, time, where: YY = Last two digit of year associated with a contact period DOY = day of year (001 through 366) associated with contact period HH = hour of the contact period within a 24 hour day (00-23) uu indicates a Sub-interval number within this contact period (00- 99) v indicates dataset version number: v = 0 for original v = 1 - 9 for reprocessed data.

File Name (contd.)				xxx indicates an LPS File type; the following file types are used in LPS: xxx = Bis for band files where: B indicates a "Band File", i indicates the :Band ID "1 through 7" for image bands 1 - 7, and "P" for the Panchromatic band 8, s indicates the file segment number s = 0 for "one segment file only", s = 1 - 4 for Pan Band file segments xxx = MSD for an MSCD file xxx = PCD for a PCD file xxx = CAL for a Calibration File xxx = MTA for a Metadata File xxx = Rnn for Multi-Browse File where nn (01-99) indicates the WRS scene number identified in the metadata file.
File Creation Date and Time:	LPS system date and time when this file was created. This time may vary from file to file within the same Level 0R file set. Note: The time format in CAPITAL letters indicates LPS/Local system generated time.	Time	16	$YY:DDD:HH:MM:SS where: YY: Julian Year (00 through 99) DDD: Day (01 through 366) HH: hours (00 through 23) MM: minutes (00 through 59) SS: seconds (00 through 59) The time is in the range from 00:001:00:00:00 to 99:365:23:59:59
File Version No.	Reprocessing indicator to distinguish this file from the Level 0R file generated earlier for the same sub-interval and provided to the LP DAAC. The reprocessing information may be tracked by LPS or entered by an operator during setup of the reprocess operation. **(TBR)**	Char	2	$R: where $ indicates a "blank space" R = 0 indicates "not a reprocessed file" R = 1 through 9" indicates the file reprocess count value

File Source ID	This field identifies the country, responsible agency and the source system which created this file.	Char	12	CCCAAAAASSSn where: CCC indicates country name such as USA AAAAA indicates responsible agency such as "NOAA" in the case of LPS. SSS indicates the source ground station (e.g. EDC) and or a system such as the LPS. n indicates the source system string number (1 to 9) which generated the file
Total File Segments	This fields indicates the total number segments making this file is segmented. This field is used to indicate LPS Band 8 file segments.	Intgr	1	S = 0 indicates that this file is a single file with no segments. S = 1 -4 indicates the total number of segments making this file.
File Segment No.	Applicable only to the LPS Panchromatic (Band 8) file. This field allows LPS to segment a Band 8 subinterval into smaller segments to overcome system/data storage and transfer limitations.	Intgr	1	N = 0 indicates that this file is a single file with no segments. N = 1 - 4 indicates the file segment number for this file. LPS allows from 1 to 4 segments for its Band 8 (Panchromatic Band) file.
Software Version No.	Version number of the software on the source system when this file was created.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
IAS Parameter Version No.	The version No. of the IAS Parameter file used in generating this file.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
Data Descriptor				
File Record Number	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000002 indicates the data descriptor record

Spacecraft Identification	Spacecraft identification as reported in the SCID field (bits 2 through 9) of the first valid CADU of the first ETM+ (scan) reported in this file. A valid CADU/VCDU has no errors.	Char	8	Landsat7
ETM+ Format	This field identifies the ETM+ Format ,1 or 2, applicable for providing an allowable band data in this file. The ETM+ format information is extracted from the PCD/Status data field of the first valid VCDU of the first major frame of the sub-interval reported in this file. A valid VCDU has no errors.	Char	2	Fn where: Fn = F1 for ETM+ Format 1 data Fn = F2 for ETM+ Format 2 data
Contact Period Start Time	The Start Date and Time when the contact period associated with this sub-interval was acquired from the Landsat 7 spacecraft via the LGS.	Time	16	$YY:DDD:HH:MM:SS (See above for details)
Contact Period Stop Time	The Stop Date and Time when the contact period associated with this sub-interval was acquired from the Landsat 7 spacecraft via the LGS.	Time	16	$YY:DDD:HH:MM:SS (See above for details)
Orbit Number:	Landsat 7 orbit number, since spacecraft launch, is calculated by LPS. Approximately 26591 orbits are possible during a 5 year mission period.	Char	6	BBBBBB: where BBBBBB: 00001 through 99999
WRS Path:	Reference WRS path number for all scenes included in this sub-interval.	Intgr	3	PPP: 001 through 233
Starting Row	The starting WRS row number (nominal) for the scene data included in this sub-interval.	Intgr	3	RRR: 001 through 248
Ending Row	The ending WRS Row Number (nominal) for the scene data included in this sub-interval.	Intgr	3	RRR: 001 through 248

Sub-interval Spacecraft Start Time	The spacecraft time extracted from the timecode minor frames of the first ETM+ major frame of the sub-interval reported in this file. (Note: The year information (Capitalized) is appended by LPS to the ETM+ timecode format.)	Time	20	$YY:ddd:hh:mm:ss.ttt with a range YY: Last two digits of Julian Year ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) The time is in the range from: 00:001:00:00:00.000 through 99:366:23:59:59.999
Sub-interval Spacecraft Stop Time	The spacecraft time extracted from the timecode minor frames of the last ETM+ major frame of the sub-interval reported in this file.	Char	20	$YY:ddd:hh:mm:ss.ttt with a range YY: Last two digits of Julian Year ddd: Day (01 through 31) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) ttt: milliseconds (000 through 999) The time is in the range from: 00:001:00:00:00.000 through 99:366:23:59:59.999
Total ETM+ Scans (S)	The total number of ETM+ scans reported in this subinterval file. A maximum of 13,125 scans can be received in a 14 minute subinterval (based on a maximum of 35 scenes, each consisting of at most 375 scans)	Intgr	6	SSSSSS in the range of 000325 to 13,125
PCD Start Time	Time of the first PCD major frame in the PCD file associated with this sub-interval.	Time	16	ddd:hh:mm:ss.ttt (See above for details)
PCD Stop time	Time of the last PCD major frame in the PCD file associated with this sub-interval.	Time	16	ddd:hh:mm:ss.ttt (See above for details)

Total PCD Major Frames	Total Number of PCD Major Frames present in the PCD file associated with this sub-interval. Approximately 212 major frames can be received by the LPS during a 14.1 minute long sub-interval.	Intgr	4	MMMM: in the range from 0000 through 9999
ETM+ Last On Time	This field is as defined in the Landsat 7 DFCB. See PCD locator table in the appendix for locating this information in a PCD major frame. This information is in a 48-bit extended precision floating point value in seconds from midnight of the first day of the current year. A maximum of 31,622,400 seconds are possible in a year.	Time	20	$ddd:hh:mm:ss.ttt:ff with a range from 001:00:00:00.000:00 through 366:23:59:59.999.15 (ee format details above) Note: The PCD extracted time is in floating point format S39.8 where: S is the sign bit 39 indicates a 39 bit mantissa, and 8 indicates an 8 bit exponent. It needs to be converted to time format.
ETM+ Last Off Time	This field is as defined in the Landsat 7 DFCB. See PCD locator table in the appendix for locating this information in a PCD major frame. This information is in a 48-bit extended precision floating point value in seconds from midnight of the first day of the current year. A maximum of 31,622,400 seconds are possible in a year.	Time	20	$ddd:hh:mm:ss.ttt:ff with a range from 001:00:00:00.000:00 through 366:23:59:59.999.15 (ee format details above)
Bands Present	This information is extracted from the third PCD major frame, minor frame 32, word 72, bits 0 through 6. All bands present in either Format 1 or Format 2 data are shown by their respective band numbers. A missing band is indicated by a "-" in its respective position.	Char	6	nnnnnn: where: nnnnnn: 123456 indicates that all bands in Format 1 data are present OR nnnnnn: 678$$$ indicates that all bands in Format 2 data are present A missing band is shown by a "-" Band 8 is the Pan band.
Total WRS Scenes	The total number of WRS scenes contained in this sub-interval. A maximum of 35 full scenes can be received by LPS in a 14.1 minute long sub-interval.	Intgr	2	SS: in the range from 00 through 99

Band 1/6 File Name	Image Band 1 File Name (if Format 1 data) associated with this sub-interval. OR Image Band 6 File Name (if Format 2 data) associated with this sub-interval.	Char	22	L7XsssfnYYDOYHHuuv.xxx where: L7 indicates the Landsat 7 mission X = 1, 2 or 3 for the L7 X-band used to downlink data to the LGS sss indicates ground station source indicator, for example: sss = EDC at Sioux Falls, SD sss = ANC for Anchorage, Alaska (EDC uses 3 letter ground station name in a figure in the LPS Ops Concept) f indicates ETM+ data format: f = 1 for Format 1 data f = 2 for Format 2 data n indicates LPS processor number (1-9) YYDOYHH: indicates Landsat 7 contact period receive date, time, where: YY = Last two digit of year associated with a contact period DOY = day of year (001 through 366) associated with contact period HH = hour of the contact period within a 24 hour day (00-23) uu indicates a Sub-interval number within this contact period (00- 99) v indicates dataset version number: v = 0 for original v = 1 - 9 for reprocessed data. xxx indicates an LPS File type; the following file types are used in LPS: xxx = Bis for band files where: B indicates a "Band File", i indicates the :Band ID "1 through 7" for image bands 1 - 7, and "P" for the Panchromatic band 8, s indicates the file segment number s = 0 for "one segment file only", s = 1 - 4 for Pan Band file segments

Band 1/6 File Name (contd.)				xxx = MSD for an MSCD file xxx = PCD for a PCD file xxx = CAL for a Calibration File xxx = MTA for a Metadata File xxx = Rnn for Multi-Browse File where nn (01-99) indicates the WRS scene number identified in the metadata file. xxx indicates an LPS File type; the following file types are used in LPS: xxx = Bis for band files where: B indicates a "Band File", i indicates the :Band ID "1 through 7" for image bands 1 - 7, and "P" for the Panchromatic band 8, s indicates the file segment number s = 0 for "one segment file only", s = 1 - 4 for Pan Band file segments xxx = MSD for an MSCD file xxx = PCD for a PCD file xxx = CAL for a Calibration File xxx = MTA for a Metadata File xxx = Rnn for Multi-Browse File where nn (01-99) indicates the WRS scene number identified in the metadata file.
Band 2/7 File Name	Image Band 2 File Name (if Format 1 data) associated with this sub-interval. OR Image Band 7 File Name (if Format 2 data) associated with this sub-interval.	Char	22	L7XsssfnYYDOYHHuuv.xxx (same as defined above)
Band 3/8 File Name	Image Band 3 File Name (if Format 1 data) associated with this sub-interval. OR Image Band 8 File Name (if Format 2 data) associated with this sub-interval.	Char	22	L7XsssfnYYDOYHHuuv.xxx (same as defined above)

Band 4 File Name	Image Band 4 File Name (Format 1 only) associated with this sub-interval. No band file name/record is included in a Format 2 file.	Char	22	L7XsssfnYYDOYHHuuv.xxx (same as defined above)
Band 5 File Name	Image Band 5 File Name (Format 1 only) associated with this sub-interval. No band file name/record is included in a Format 2 file.	Char	22	L7XsssfnYYDOYHHuuv.xxx (same as defined above)
Band 6 File Name	Image Band 6 File Name (Format 1 only) associated with this sub-interval. No band file name/record is included in a Format 2 file.	Char	22	L7XsssfnYYDOYHHuuv.xxx (same as defined above)
MSCD File Name	Name of the Mirror Scan Correction Data (MSCD) File associated with this sub-interval.	Char	22	L7XsssfnYYDOYHHuuv.xxx same as defined above. xxx = MSD for an MSCD file
PCD File Name	Name of the Payload Correction Data (PCD) File associated with this sub-interval.	Char	22	L7XsssfnYYDOYHHuuv.xxx same as defined above. xxx = PCD for a PCD file
Calibration File Name	Name of the Calibration File (Format 1 or Format 2) associated with this sub-interval.	Char	22	L7XsssfnYYDOYHHuuv.xxx same as defined above. xxx = CAL for a Calibration File
Browse File Name(s)	Names of all Multi-Browse File (Format 1 only) associated with this sub-interval. This filed is repeated for each WRS scene included in this subinterval. A maximum of 35 WRS scenes in subinterval are possible.	Char	22	L7XsssfnYYDOYHHuuv.xxx same as defined above. xxx = Rnn for Multi-Browse File where nn (01-99) indicates the WRS scene number identified in the metadata file.
Scene Metadata Records	**The following fields are repeated for each WRS scene included in the sub-interval.**			
File Record Number	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000,003 indicates the data descriptor record
WRS Scene Number	WRS Scene Number SSSS in this sub-interval.	Intgr	3	SSSS: in the range from 0001 through 0099
WRS Path	WRS Scene Path Number	Intgr	3	PPP: 0001 through 0233

WRS Row	WRS Scene Row Number	Intgr	3	RRR: 0001 through 0248
Scene Center Scan Number	The scan number in this sub-interval which is found to be closest to a nominal WRS Scene Center for this scene. The scan number, in a 14.1 minute long sub-interval can be as high as 11839.	Intgr	6	nnnnnn: 000001 through 999999
Scene Center Scan Time	WRS Scene Center Scan Time	Time	18	YY:DDD:hh:mm:ss.ttt (See above for details)
Scene Center Latitude	WRS Scene Center Latitude - Nominal from WRS Map	Real	16	STTTTTTT.TTTTTTT in the range from 0.0 through 90.0 degrees S: + defines latitude to the North S: - defines latitude to the south
Scene Center Longitude	WRS Scene Center Longitude - Nominal from WRS Map	Real	16	SNNNNNNN.NNNNNNN in the range from 0.0 through 180.0 degrees S: + defines longitude to the East S: - defines longitude to the West
Horizontal Display Shift	WRS Scene Center Horizontal Display Shift	Intgr	4	MMMM meters in 0001 - 9999 range
Upper Left Corner Latitude	WRS Scene Upper Left Corner Latitude	Real	16	STTTTTTT.TTTTTTT (see above for definition)
Upper Left Corner Longitude	WRS Scene Upper Left Corner Longitude - Nominal Value (TBR)	Real	16	SNNNNNNN.NNNNNNN (see above for definition)
Upper Right Corner Latitude	WRS Scene Upper Right Corner Latitude - Nominal Value (TBR)	Real	16	STTTTTTT.TTTTTTT (see above for definition)
Upper Right Corner Longitude	WRS Scene Upper Right Corner Longitude - Nominal Value (TBR)	Real	16	SNNNNNNN.NNNNNNN (see above for definition)
Lower Left Corner Latitude	WRS Scene Lower Left Corner Latitude - Nominal Value (TBR)	Real	16	STTTTTTT.TTTTTTT (see above for definition)
Lower Left Corner Longitude	WRS Scene Lower Left Corner Longitude - Nominal Value (TBR)	Real	16	SNNNNNNN.NNNNNNN (see above for definition)

Lower Right Corner Latitude	WRS Scene Lower Right Corner Latitude - Nominal Value (TBR)	Real	16	STTTTTTT.TTTTTTT (see above for definition)
Lower Right Corner Longitude	WRS Scene Lower Right Corner Longitude - Nominal Value (TBR)	Real	16	STTTTTTT.TTTTTTT (see above for definition)
Scene CCA	Cloud Cover Assessment (full Scene)	Intgr	3	cccc: 0% to 100% cloud cover
Quad 1 CCA	Cloud Cover Assessment (Upper Left Quadrant)	Intgr	3	cccc: 0% to 100% cloud cover
Quad 2 CCA	Cloud Cover Assessment (Upper Right Quadrant)	Intgr	3	cccc: 0% to 100% cloud cover
Quad 3 CCA	Cloud Cover Assessment (Lower Left Quadrant)	Intgr	3	cccc: 0% to 100% cloud cover
Quad 4 CCA	Cloud Cover Assessment (Lower Right Quadrant)	Intgr	3	cccc: 0% to 100% cloud cover
ACCA Algorithm ID	Identifies the ACCA algorithm name/version number used by LPS in assessing the cloud cover assessment reported for this scene.	Char	12	**AAAAAAAAAAAA** **TBR - Algorithm ID/version No.**
Sun Azimuth Angle	Sun Azimuth Angle **(TBR)**	Real	12	SNNN.NNNNNNN in the range from 0.0 through 180.0 degrees S: + or -
Sun Elevation Angle	Sun Elevation Angle **(TBR)**	Real	12	SNNN.NNNNNNN in the range from 0.0 through 180.0 degrees S: + or -
Band Gains	Band Gains at the start of a WRS Scene. The Band gains information is extracted by LPS from Words 7 and 8 of the PCD/Status data Field contained in the VCDU.	Char	6	gggggg: where g's indicate band positions 123456 for Format 1 data OR 678$$$ for Format 2 data where: $$$ indicates 3 blanks spaces. g = L in a band position indicates a Low gain g = H in a band position indicates a High gain

Band Gain Changes	Band Gain Change Flags generated by LPS.	Char	6	gggggg: where g's indicate band positions 123456 for Format 1 data OR 678$$$ for Format 2 data where: $$$ indicates 3 blanks spaces. g = 0 in a band position indicates no change in gain during this scene g = 1 in a band position indicates a change in gain during this scene.
Full Aperture Cal. Activity Flag	This field indicates the ETM+ Full Calibration Activity during this scene. The calibration door activity flag is interpolated from "serial word P of the third PCD major frame, minor frame 83, word 72, bits 2 and 3.	Char	1	**F: 0 or 1** **0: indicates no Full calibration activity during this scene** **1: indicates Full calibration activity**
Partial Aperture Cal. Activity Flag	This field indicates the ETM+ Partial Calibration Activity during this scene. This flag indicates the day/night condition for the current scene. LPS determines the day/night (Partial Aperture Cal. Activity) condition by comparing the Sun Azimuth and Elevation values against known angle values.	Char	1	**P: 0 or 1** **0: indicates no partial calibration activity during this scene (Day Scene)** **1: indicates partial calibration activity (day/night transition)** **TBR**
Image Q&A Data	**The following fields are repeated for each WRS scene included in this sub-interval.**			
CADUs/VCDUs Received	Total Number of CADUs/VCDUs contained in this sub-interval. The largest size sub-interval if received by LPS, will contain approximately **7,626,201 CADUs/VCDUs for a longest size contact period of 14.1 minutes.**	Intgr	8	cccccccc: in the range from 00000001 through 99999999
Fly-wheeled CADUs	The percent of CADUs fly-wheeled due to sync errors.	Intgr	4	FFF%: in the range from 000% - 100%
R-S Error VCDUs	The percent of VCDUs with Reed-Solomon error corrected in the header field.	Intgr	4	RRR%: in the range from 000% - 100%

BCH Corrected VCDUs	The percent of VCDUs with BCH errors corrected for up to 3 bits in their mission data fields.	Intgr	4	CCC%: in the range from 000% - 100%
BCH Uncorrected VCDUs	The total number of VCDUs containing uncorrected BCH errors (bits) in their mission data fields.	Intgr	4	UUU%: in the range from 000% - 100%
Bit Error Rate	The average number of bit errors found in blocks of 100,000 bits aggregated over the length of this sub-interval. This BER is calculated using bit errors detected (corrected or not) during CRC and BCH checks of the input VCDUs. An input data bit error rate of 1 in 100,000 or less is considered acceptable.	Intgr	4	BBBB: in the range from 0000 - 9999 BBBB = **** indicates counter overflow (BBBB > 9999).
ETM+ Timecode Errors	The percent of ETM+ Scans (major frames) detected with errors in their time code fields during processing of this sub-interval. There are approximately 11755 major frames in a 14 minute long contact period (the largest possible sub-interval).	Intgr	4	TTT%: in the range from 000% - 100%
Entirely Filled Scans	The percent of ETM+ major frames in this sub-interval which were entirely filled using a pre-determined fill data pattern.	Intgr	4	FFF%: in the range from 000% - 100%
Partially Filled Scans	The percent of ETM+ major frames in this sub-interval which were partially filled using a pre-determined fill data pattern.	Intgr	4	PPP%: in the range from 000% - 100%
PCD Q&A Data	**The following fields are repeated for each WRS scene included in the sub-interval.**			
PCD Words Received	The total number of PCD words, extracted from the unpacked PCD bytes (one sync byte, 3 repeated data bytes and a fill byte), received during this subinterval. Approximately 3,470,000 PCD bytes can be received by LPS during a 14.1 minute long sub-interval.	Intgr	8	wwwwwwww in the range from 00000000 to 3500000

PCD Byte Voting Errors	The percent of PCD Word which encountered byte voting errors during packing.	Intgr	4	VVV%: in the range from 000% - 100%
Total PCD Minor Frames	The total number of PCD minor frames constructed during this subinterval. Approximately 27,072 PCD minor frames can be received by LPS during a 14.1 minute long sub-interval.	Intgr	6	mmmmmm in the range 000000 to 30000
PCD Minor Frame Errors	The percent of PCD minor frames which encountered sync errors during their construction.	Intgr	4	SSS%: in the range from 000% - 100%
Filled PCD Minor Frames	The percent of PCD minor frames which required a data fill during their construction.	Intgr	4	NNN%: in the range from 000% - 100%
Filled PCD Major Frames	The total number of PCD major frames which required a data fill during their construction. Approximately 212 major frames can be received by the LPS during a 14.1 minute long sub-interval.	Intgr	4	JJJ%: in the range from 000% - 100%
Processed PCD Q&A Data	**The following fields are repeated for each WRS scene included in the sub-interval.**			
Attitude Data Points	The total number of spacecraft attitude data points (quaternations) received and processed from the PCD of this subinterval. Approximately 848 spacecraft attitude data points can be received during a 14.1 minute long sub-interval.	Intgr	4	AAAA: in the range from 0000 through 9999
Rejected Attitude Data	The percent of spacecraft attitude data points (quaternations) found to fail the PCD quality checks. The rejected data points are flagged and included in the PCD file associated with this sub-interval.	Intgr	4	AAA%: in the range from 000% - 100%
Missing Attitude Data	The percent of spacecraft attitude data points (quaternations) found missing during PCD quality checks. The missing data points are flagged and included in the PCD file associated with this sub-interval.	Intgr	4	MMM%: in the range from 000% - 100%

Ephemeris Data Points	The total number of ephemeris data points received and processed from the PCD of this sub-interval. Approximately 212 ephemeris data points can be received during a 14.1 minute long sub-interval.	Intgr	4	EEEE: in the range from 0000 through 9999
Rejected Ephemeris Data	The percent of spacecraft ephemeris data points found to fail LPS PCD quality checks. The rejected data points are flagged and included in the PCD file associated with this sub-interval.	Intgr	4	EEE%: in the range from 000% - 100%
Missing Ephemeris Data	The percent of spacecraft ephemeris data points found missing during PCD quality checks. The missing data points are flagged and included in the PCD file associated with this sub-interval.	Intgr	4	MMM%: in the range from 000% - 100%
WRS Scenes not Calculated	This count indicates the number of WRS scenes in this subinterval which could not be calculated because not enough data points (attitude and ephemeris) were available. A minimum of 6 consecutive points are required to calculate a WRS scene center.	Intgr	2	SS: in the range from 00 through 99 **(TBR - not an F&PS requirement)**

4.2.3 Metadata File Format (HDF/PVL)

The metadata file format conforms to the HDF PVL (parameter value language) structure. Details on the PVL file structure is provided in Applicable Document 2.1.6. Sections 4.2.3.1 and 4.2.3.2 illustrate the use of the HDF PVL for constructing the LPS Format 1 and Format 2 metadata files, respectively.

4.2.3.1 HDF PVL Example - Format 1 Metadata File

/* LPS Level 0R Subinterval Metadata File - Format 1 */

BEGIN_GROUP = SUBINTERVAL_METADATA_FILE1;

/* Metadata File Identification (File Descriptor) */

BEGIN_GROUP = FILE_DESCRIPTOR;
FILE_ RECORD_NO = 000001;
FILE_NAME = L71EDC139813513011.MTA;
FILE__GEN_ DATE/TIME = 1998-05-15T13:30:25ZZ;
FILE_VERSION_NO = 01;
FILE_SOURCE_ID = USAEDC--LPS3;
TOTAL_FILE_SEGMENTS = 0;
FILE_SEGMENT_NO = 0
SOFTWARE_VER_NO = 1.1;
IAS_PARAM_FILE_VER_NO = 1.3;
END_GROUP = FILE_DESCRIPTOR;

/* Subinterval Level Metadata */

BEGIN_GROUP = DATA_DESCRIPTOR;

FILE_RECORD_NO = 000002;

BEGIN_GROUP = SUBINTERVAL_METADATA;
SPACECRAFT_ID = "Landsat 7";
ETM+_FORMAT = 1;
CONTACT_PERIOD_START_TIME = 1998-05-15T11:23:01;
CONTACT_PERIOD_STOP_TIME = 1998-05-15T11:37:10;
ORBIT_NO = 00003;
WRS_PATH = 0029;
STARTING_ROW = 0020;
ENDING_ROW = 0045;
SUBINTERVAL_START_TIME = 1998-05-15T11:25:01.350;
SUBINTERVAL_STOP_TIME = 1998-05-15T11:35:05.650;
TOTAL_ETM+_SCANS = 8853;
PCD_START_TIME = 1998-05-15T11:25:01.250;
PCD_STOP_TIME =1998-05-15T11:35:05.750;
TOTAL_ PCD_MAJOR_FRAMES = 101;
ETM+_LAST_ON_TIME = 1998-05-15T11:15:01.350;
ETM+_LAST_OFF_TIME = 1998-05-15T09:25:01.350;
BANDS_PRESENT = 123456;
TOTAL_WRS_SCENES = 25;
BAND_1_FILE_NAME = L71EDC139813513011.BB1;
BAND_2_FILE_NAME = L71EDC139813513011.BB2;
BAND_3_FILE_NAME = L71EDC139813513011.BB3;
BAND_4_FILE_NAME = L71EDC139813513011.BB4;
BAND_5_FILE_NAME = L71EDC139813513011.BB5;
BAND_6_FILE_NAME = L71EDC139813513011.BB6;
MSCD_FILE_NAME = L71EDC139813513011.MSD;
PCD_FILE_NAME = L71EDC139813513011.PCD;

CAL_FILE_NAME = L71EDC139813513011.CAL;
BROWSE_FILE_01 = L71EDC139813513011.R01;
BROWSE_FILE_02 = L71EDC139813513011.R02;
BROWSE_FILE_03 = L71EDC139813513011.R03;
BROWSE_FILE_04 = L71EDC139813513011.R04;
BROWSE_FILE_05 = L71EDC139813513011.R05;
BROWSE_FILE_06 = L71EDC139813513011.R06;
BROWSE_FILE_07 = L71EDC139813513011.R07;
BROWSE_FILE_08 = L71EDC139813513011.R08;
BROWSE_FILE_09 = L71EDC139813513011.R09;
BROWSE_FILE_10 = L71EDC139813513011.R10;
BROWSE_FILE_11 = L71EDC139813513011.R11;
BROWSE_FILE_12 = L71EDC139813513011.R12;
BROWSE_FILE_13 = L71EDC139813513011.R13;
BROWSE_FILE_14 = L71EDC139813513011.R14;
BROWSE_FILE_15 = L71EDC139813513011.R15;
BROWSE_FILE_16 = L71EDC139813513011.R16;
BROWSE_FILE_17 = L71EDC139813513011.R17;
BROWSE_FILE_18 = L71EDC139813513011.R18;
BROWSE_FILE_19 = L71EDC139813513011.R19;
BROWSE_FILE_20 = L71EDC139813513011.R20;
BROWSE_FILE_21 = L71EDC139813513011.R21;
BROWSE_FILE_22 = L71EDC139813513011.R22;
BROWSE_FILE_23 = L71EDC139813513011.R23;
BROWSE_FILE_24 = L71EDC139813513011.R24;
BROWSE_FILE_25 = L71EDC139813513011.R25;
END_GROUP = SUBINTERVAL_METADATA;

END_GROUP = DATA_DESCRIPTOR;

/* WRS Scene Metadata Repeated for each Scene in the data records */

BEGIN_GROUP = SCENE_METADATA_RECORDS;

BEGIN_GROUP = SCENE_RECORD_1;

BEGIN_GROUP = WRS_SCENE_01_METADATA;
FILE_RECORD_NO = 000003;
WRS_SCENE_NO = 0001;
WRS_PATH = 0031; /* SIOUX FALL, SD!>
WRS_ROW = 0030; /* SIOUX FALL, SD!>
SCENE_CENTER_SCAN_NO = 000175;
SCENE_CENTER_SCAN_TIME = 1998-05-15T11:37:05.450;
SCENE_CENTER_LATTITUDE = +000042.1234567 <Degrees North>;
SCENE_CENTER_LONGITUDE = -000096.7654321 <Degrees West>;
HORIZONTAL_DISPLAY_SHIFT = 0275 <meters>;
UPPER_LEFT_CORNER_LAT = +000041.5432176 <Degrees North>;

UPPER_LEFT_CORNER_LONG = -000096.5432176 <Degrees West>;
UPPER_RIGHT_CORNER_LAT = +000041.4321765 <Degrees North>;
UPPER_RIGHT_CORNER_LONG = -000096.6543217 <Degrees West>;
LOWER_LEFT_CORNER_LAT = +000041.6543217 <Degrees North>;
LOWER_LEFT_CORNER_LONG = -000096.3543217 <Degrees West>;
LOWER_RIGHT_CORNER_LAT = +000041.3432176 <Degrees North>;
LOWER_RIGHT_CORNER_LONG = -000096.6543217 <Degrees West>;
Full_SCENE_CCA = 020 <percent>;
UPPER_LEFT_QUAD1_CCA = 001 <percent>;
UPPER_RIGHT_QUAD2_CCA = 009 <percent>;
LOWER_LEFT_QUAD3_CCA = 004 <percent>;
LOWER_RIGHT_QUAD4_CCA = 006 <percent>;
ACCA_ALGORITHM_ID_VER = "ACCA_11NOV95.ALG"
SUN_AZIMUTH_ANGLE = 020.1234567 <degrees>;
SUN_ELEVATION_ANGLE = 020.1234567 <degrees>;
BAND_GAINS = HHHHLL;
BAND_GAIN_CHANGES = NNNYNN;
FULL_APERTURE_CAL_FLAG = N;
PARTIAL_APERTURE_CAL_FLAG: D; /*Day*/
END_GROUP = WRS_SCENE_01_METADATA;

/*Scene Image Data Quality and Accounting Data */

BEGIN_GROUP = SCENE_01_ETM+_Q&A;
TOTAL_CADUS/VCDUS = 05439266;
FLYWHEEL_CADUS = 1<percent>;
R-S_ERR_VCDUS = 1<percent>;
BCH_CORRECTED_VCDUS = 1<percent>;
BCH_UNCORRECTED_VCDUS = 0<percent>;
BIT_ERR_RATE = 0.1e-6;
ETM+_TIMECODE_ERRORS = 0<percent>;
ENTIRELY_FILLED_SCANS = 0<percent>;
PARTIALLY_FILLED_SCANS = 1<percent>;
END_GROUP = SCENE_01_ETM+_Q&A;

/*Scene PCD Quality and Accounting Information */

BEGIN_GROUP = SCENE_01_PCD_Q&A;
PCD_WORDS_RECEIVED = 2470070;
PCD_BYTE_VOTING_ERR = 5<percent>;
TOTAL_PCD_MINOR_FRAMES = 19297;
PCD_MINOR_FRAME_ERR = 3<percent>;
FILLED_PCD_MINOR_FRMAES = 2<percent>;
FILLED_PCD_MAJOR_FRAMES = 1<percent>;
END_GROUP = SCENE_01_PCD_Q&A;

/Scene Processes PCD Quality and Accounting Info.*/

BEGIN_GROUP = PROCEESED_PCD_01_Q&A;

TOTAL_ATTITUDE_POINTS = 0037;
REJECTED_ATTITUDE_POINTS = 0002 <percent>;
MISSING_ATTITUDE_POINTS = 0001 <percent>;
TOTAL_EPHEMERIS__ POINTS = 0037;
REJECTED_EPHEMERIS_POINTS = 0000 <percent>;
MISSING_EPHEMERIS_POINTS = 0001 <percent>;
WRS_SCENES_NOT_CALCULATED = 0;
END_GROUP = PROCEESED_PCD_01_Q&A;

END_GROUP = SCENE_RECORD_1;

/* The WRS_SCENE_nn_METADATA GROUP is repeated untill nn > 25 */

END_GROUP = SCENE_METADATA_RECORDS;

END_GROUP = SUBINTERVAL_METADATA_FILE1;

4.2.3.2 HDF PVL Example - Foramt 2 Metadata File

```
/* LPS Level 0R Subinterval Metadata File - Format 2 */

BEGIN_GROUP = SUBINTERVAL_METADATA_FILE2;

    /* Metadata File Identification (File Descriptor) */

    BEGIN_GROUP = FILE_DESCRIPTOR;
        RECORD_NO = 000001,
        FILE_NAME = L71EDC239813513011.MTA;
        FILE__GEN_ DATE/TIME = 1998-05-15T13:30:25ZZ;
        FILE_VERSION_NO = 01;
        FILE_SOURCE_ID = USAEDC--LPS3;
        TOTAL_FILE_SEGMENTS = 0;
        FILE_SEGMENT_NO = 0
        SOFTWARE_VER_NO = 1.1;
        IAS_PARAM_FILE_VER_NO = 1.3;
    END_GROUP = FILE_DESCRIPTOR;

    /* Subinterval Level Metadata */

    BEGIN_GROUP = DATA_DESCRIPTOR;

        RECORD_NO = 000002;

        BEGIN_GROUP = SUBINTERVAL_METADATA;
        SPACECRAFT_ID = "Landsat 7";
        ETM+_FORMAT = 2;
        CONTACT_START_TIME = 1998-05-15T11:23:01
        CONTACT_STOP_TIME = 1998-05-15T11:37:10
        ORBIT_NO = 00003;
        WRS_PATH = 0029;
        STARTING_ROW = 0020;
        ENDING_ROW = 0045;
        SUBINTERVAL_START_TIME = 1998-05-15T11:25:01.350;
        SUBINTERVAL_STOP_TIME = 1998-05-15T11:35:05.650;
        TOTAL_ETM+_SCANS = 8853;
        PCD_START_TIME = 1998-05-15T11:25:01.250;
        PCD_STOP_TIME =1998-05-15T11:35:05.750;
        TOTAL_ PCD_MAJOR_FRAMES = 101;
        ETM+_LAST_ON_TIME = 1998-05-15T11:15:01.350;
        ETM+_LAST_OFF_TIME = 1998-05-15T09:25:01.350;
        BANDS_PRESENT = 678---;
        TOTAL_WRS_SCENES = 25;
        BAND_6_FILE_NAME = L71EDC239813513011.BB6;
```

BAND_7_FILE_NAME = L71EDC239813513011.BB7;
BAND_8_FILE_NAME = L71EDC239813513011.BB8;
MSCD_FILE_NAME = L71EDC239813513011.MSD;
PCD_FILE_NAME = L71EDC239813513011.PCD;
CAL_FILE_NAME = L71EDC239813513011.CAL;
END_GROUP = SUBINTERVAL_METADATA;

END_GROUP = DATA_DESCRIPTOR;

/* WRS Scene-by-Scene Metadata for this Level 0R Subinterval */
/* Note: The WRS Scene Centers Correspond to Band 7 Scan Times */

BEGIN_GROUP = SCENE_METADATA_RECORDS;

BEGIN_GROUP = SCENE_RECORD_1;

BEGIN_GROUP = WRS_SCENE_01_METADATA;
FILE_RECORD_NO = 000003;
WRS_SCENE_NO = 0001;
WRS_PATH = 0031; /* EDC at SIOUX FALL, SD!>
WRS_ROW = 0030; /* EDC at SIOUX FALL, SD!>
SCENE_CENTER_SCAN_NO = 000175;
SCENE_CENTER_SCAN_TIME = 1998-05-15T11:37:05.450;
SCENE_CENTER_LATTITUDE = +000042.1234567 <Degrees North>;
SCENE_CENTER_LONGITUDE = -000096.7654321 <Degrees West>;
HORIZONTAL_DISPLAY_SHIFT = 0275 <meters>;
UPPER_LEFT_CORNER_LAT = +000041.5432176 <Degrees North>;
UPPER_LEFT_CORNER_LONG = -000096.5432176 <Degrees West>;
UPPER_RIGHT_CORNER_LAT = +000041.4321765 <Degrees North>;
UPPER_RIGHT_CORNER_LONG = -000096.6543217 <Degrees West>;
LOWER_LEFT_CORNER_LAT = +000041.6543217 <Degrees North>;
LOWER_LEFT_CORNER_LONG = -000096.3543217 <Degrees West>;
LOWER_RIGHT_CORNER_LAT = +000041.3432176 <Degrees North>;
LOWER_RIGHT_CORNER_LONG = -000096.6543217 <Degrees West>;
SUN_AZIMUTH_ANGLE = 020.1234567 <degrees>;
SUN_ELEVATION_ANGLE = 020.1234567 <degrees>;
BAND_GAINS = HLL;
BAND_GAIN_CHANGES = YNN;
FULL_APERTURE_CAL_FLAG = Y;
PARTIAL_APERTURE_CAL_FLAG: N /*Night*/;
END_GROUP = WRS_SCENE_01_METADATA;

/*Scene Image Data Quality and Accounting Data */

BEGIN_GROUP = SCENE_01_ETM+_Q&A;
TOTAL_CADUS/VCDUS = 05439266;
FLYWHEEL_CADUS = 1<percent>;
R-S_ERR_VCDUS = 1<percent>;

BCH_CORRECTED_VCDUS = 1<percent>;
BCH_UNCORRECTED_VCDUS = 0<percent>;
BIT_ERR_RATE = 0.1e-6;
ETM+_TIMECODE_ERRORS = 0<percent>;
ENTIRELY_FILLED_SCANS = 0<percent>;
PARTIALLY_FILLED_SCANS = 1<percent>;
END_GROUP = SCENE_01_ETM+_Q&A;

/*Scene PCD Quality and Accounting Information */

BEGIN_GROUP = SCENE_01_PCD_Q&A;
PCD_WORDS_RECEIVED = 2470070;
PCD_BYTE_VOTING_ERR = 5<percent>;
TOTAL_PCD_MINOR_FRAMES = 19297;
PCD_MINOR_FRAME_ERR = 3<percent>;
FILLED_PCD_MINOR_FRMAES = 2<percent>;
FILLED_PCD_MAJOR_FRAMES = 1<percent>;
END_GROUP = SCENE_01_PCD_Q&A;

/Scene Processes PCD Quality and Accounting Info.*/

BEGIN_GROUP = PROCEESED_PCD_01_Q&A;
TOTAL_ATTITUDE_POINTS = 0037;
REJECTED_ATTITUDE_POINTS = 0002 <percent>;
MISSING_ATTITUDE_POINTS = 0001 <percent>;
TOTAL_EPHEMERIS__ POINTS = 0037;
REJECTED_EPHEMERIS_POINTS = 0000 <percent>;
MISSING_EPHEMERIS_POINTS = 0001 <percent>;
WRS_SCENES_NOT_CALCULATED = 0;
END_GROUP = PROCEESED_PCD_01_Q&A;

END_GROUP = SCENE_RECORD_1;

/* The WRS_SCENE_nn_METADATA GROUP is repeated untill nn > 25 */

END_GROUP = SCENE_METADATA_RECORDS;

END_GROUP = SUBINTERVAL_METADATA_FILE2;

4.3 Multibrowse File Format (TBR)

The LPS provides a multibrowse image for each of the WRS scene identified in the metadata file of a subinterval. The LPS multibrowse image, before conversion to the HDF format, consists of three 8-bit reduced size images generated from three of the ETM+ Format 1 bands (1 through 6) selected by the operator before the start of data processing. No multibrowse images are generated by LPS for the ETM+ Format 2 bands (6, 7 and 8). This section describes the LPS multibrowse output file format before its conversion to HDF and transfer to the LP DAAC. Specific details on the HDF formatted multibrowse image are provided in the HDF-EOS Primer for Version 1 EOSDIS (175-WP-001-001, April 1995). This section provides minimum information for converting LPS multibrowse output images to the HDF format.

4.3.1 Multi-browse File Overview

The LPS multibrowse output file (package) contains two data objects, a multibrowse image and a text dataset. The multibrowse image consists of three 8 bit reduced size image planes (suitable for interleave by plane in HDF). All three image planes are of the same size and aspect ratio. The nominal size of these image planes depends on the size of the input band image and the subsampling and the wavelet run factors used in producing the multibrowse image in LPS. The LPS assumes/uses an input band image size of 6330 pixels X 5600 scans lines (nominal, TBR) for a full WRS scene and uses a subsampling factor of 2 (reduction by 4) with two Wavelet runs (another reduction by 16 (4x4)) for generating the multibrowse images. This results in a nominal size of 791 X 700 for the LPS output multibrowse image. Figure 4-3 provides an overview of the LPS output multibrowse image file. The LPS randomly chooses the input band detectors for generating multibrowse images. This is expected to assure that proper operation of all bands is by Landsat user receiving/using the multibrowse images.

Note, if an input image size of 6967 x 5956, known to Landsat 4/5 users, is used with the same reduction factors, the LPS will produce a 871 X 746 size browse image. The LPS chosen image input image size of 6330 X 5600 is based on a nominal scan length of 6313 pixels plus a bumper wear allowance of 17 pixels and a nominal scene length of 350 scans by 16 detector wide bands.

The multibrowse text dataset consists of a multibrowse file header and a multibrowse descriptor. Tables 4-11 provides a summary of the LPS multibrowse text dataset. No color palette is provided by LPS. It is considered a multibrowse user responsibility.

4.3.2 Multi-browse File Description

Details on the Text dataset of the LPS multibrowse output file is described in Table 4-12.

LPS Multibrowse Text

- **Multibrowse File header**
- **Multibrowse Descriptor**

Notes:
- Multibrowse ouput size: 1.6 MB (for 3 8-bit planes)
- reduction factor: 8 X 8 = 64
- Multibrowse output image is compressed to <= 1 MB using HDF/JPEG (Ratio ~ 60%) before transfer to LP DAAC
- The band image data aspect ratio is maintained in multi-browse and in JPEG output.

Figure 4-4: LPS Produced Multi-Browse Image File (Object) (Before HDF/JPEG Compression)

Table 4-11: LPS Processed Multibrowse Text Dataset Summary

	Field Size (Bytes)	
File Descriptor		
File Record No. 1	6	
File Name	22	
File Creation Date & Time	16	
File Version No.	2	
File Source ID	12	
Total File Segments	1	
File Segment No.	1	Applicable to Band 8 file only
Software Version No.	4	
IAS Parameter Version No.	4	
Data Descriptor		
File Record No 2	6	
Spacecraft ID	8	
ETM+ Format	2	
Ref. Metadata File Name	22	
WRS Scene No.	2	
WRS Scene Center Time	20	
WRS Scene Width (X)	4	(Nominal Scan Line Length for the input WRS Scene)
WRS Scene Length (Y)	4	(Actual number of Scan Lines in the input WRS Scene)
Band IDs	3	
Starting Detectors	6	
Subsample Factor	1	
Wavelet Runs	1	
HDF/JPEG Compression Factor	2	Percent of input size
Multibrowse Image Width (x)	4	
Multibrowse Image Length (y)	4	(Actual in LPS Multibrowse output)
HDF Browse Format	5	RIS8 or RIS24

HDF Browse Interleave	1	Red (R), Green (G) and Blue (B) interleaving by pixels, by scan-line or by scan-plane.

Table 4-12: Multi-browse File Format Description

Attribute (Field) Name	Attribute (Field) Description	Type	Field Size (Bytes)	Field Format / Valid Range / Value ($ sign indicates a blank space)
File Descriptor				
File Record Number	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000001 indicates that this is the start of the file descriptor record
File Name	Landsat 7/LPS Standard File Name **(TBR)** Note 1: The Level 0R file naming scheme described here has been review by the Landsat 7 and the ECS Projects. Additional concurrence from International Ground Station is required.	Char	22	L7XsssfnYYDOYHHuuv.xxx where: L7 indicates the Landsat 7 mission X = 1, 2 or 3 for the L7 X-band used to downlink data to the LGS sss indicates ground station source indicator, for example: sss = EDC at Sioux Falls, SD sss = ANC for Anchorage, Alaska (EDC uses 3 letter ground station name in a figure in the LPS Ops Concept) f indicates ETM+ data format: f = 1 for Format 1 data f = 2 for Format 2 data n indicates LPS processor number (1-9) YYDOYHH: indicates Landsat 7 contact period receive date, time, where: YY = Last two digit of year associated with a contact period DOY = day of year (001 through 366) associated with contact period HH = hour of the contact period within a 24 hour day (00-23) uu indicates a Sub-interval number within this contact period (00- 99) v indicates dataset version number: v = 0 for original v = 1 - 9 for reprocessed data.

File Name (contd.)				xxx indicates an LPS File type; the following file types are used in LPS: xxx = Bis for band files where: B indicates a "Band File", i indicates the :Band ID "1 through 7" for image bands 1 - 7, and "P" for the Panchromatic band 8, s indicates the file segment number s = 0 for "one segment file only", s = 1 - 4 for Pan Band file segments xxx = MSD for an MSCD file xxx = PCD for a PCD file xxx = CAL for a Calibration File xxx = MTA for a Metadata File xxx = Rnn for Multi-Browse File where nn (01-99) indicates the WRS scene number identified in the metadata file.
File Creation Date and Time:	LPS system date and time when this file was created. This time may vary from file to file within the same Level 0R file set. Note: The time format in CAPITAL letters indicates LPS/Local system generated time.	Time	16	$YY:DDD:HH:MM:SS where: YY: Julian Year (00 through 99) DDD: Day (01 through 366) HH: hours (00 through 23) MM: minutes (00 through 59) SS: seconds (00 through 59) The time is in the range from 00:001:00:00:00 to 99:365:23:59:59
File Version No.	Reprocessing indicator to distinguish this file from the Level 0R file generated earlier for the same sub-interval and provided to the LP DAAC. The reprocessing information may be tracked by LPS or entered by an operator during setup of the reprocess operation. **(TBR)**	Char	2	$R: where $ indicates a "blank space" R = 0 indicates "not a reprocessed file" R = 1 through 9" indicates the file reprocess count value

File Source ID	This field identifies the country, responsible agency and the source system which created this file.	Char	12	CCCAAAAASSSn where: CCC indicates country name such as USA AAAAA indicates responsible agency such as "NOAA" in the case of LPS. SSS indicates the source ground station (e.g. EDC) and or a system such as the LPS. n indicates the source system string number (1 to 9) which generated the file
Total File Segments	This fields indicates the total number segments making this file is segmented. This field is used to indicate LPS Band 8 file segments.	Intgr	1	S = 0 indicates that this file is a single file with no segments. S = 1 -4 indicates the total number of segments making this file.
File Segment No.	Applicable only to the LPS Panchromatic (Band 8) file. This field allows LPS to segment a Band 8 subinterval into smaller segments to overcome system/data storage and transfer limitations.	Intgr	1	N = 0 indicates that this file is a single file with no segments. N = 1 - 4 indicates the file segment number for this file. LPS allows from 1 to 4 segments for its Band 8 (Panchromatic Band) file.
Software Version No.	Version number of the software on the source system when this file was created.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
IAS Parameter Version No.	The version No. of the IAS Parameter file used in generating this file.	Char	4	V.R$: where V: Version Number (1 through 9) ".": period sign R: Release Number (1 through 9)
Data Descriptor				
File Record Number	This field contains a sequence number for this record in this file. This number is incremented by 1 for each new record added to this file.	Intgr	6	QQQQQQ = 000002 indicates the data descriptor record

Spacecraft Identification	Spacecraft identification as reported in the SCID field (bits 2 through 9) of the first valid CADU of the first ETM+ (scan) reported in this file. A valid CADU/VCDU has no errors. Note: The bit count starts at 0 in the Landsat 7 DFCB.	Char	8	Landsat7
ETM+ Format	This field identifies the ETM+ Format ,1 or 2, applicable for providing an allowable band data in this file. The ETM+ format information is extracted from the PCD/Status data field of the first valid VCDU of the first major frame of the sub-interval reported in this file.	Char	2	Fn where: Fn = F1 for ETM+ Format 1 data Fn = F2 for ETM+ Format 2 data
Ref. Metadata File name	LPS standard File name for associated metadata file.	Char	22	L7XsssfnYYDOYHHuuv.MTA
WRS Scene No.	The WRS scene number in the metadata file associated with this multibrowse image. A maximum of 35 WRS scenes are expected in a 14. 1 minute long contact period/subinterval.	Intgr	2	NN = 01 - 35
WRS Scene Center Time	The WRS scene center time determined by LPS	Time	20	$YY:ddd:hh:mm:ss.ttt
WRS Scene Width (X)	Nominal Scan Line Length for the input WRS Scene. A nominal of 6330 (including 17 for scanner bumper wear) are expected on an ETM+ scan basis.	Intgr	4	PPPP: Pixels per scan lines (up to 6330 nominal)
WRS Scene Length (Y)	Actual number of Scan Data Lines in the input WRS Scene. A nominal length of 5600 scan data lines (350 scans X 16 detectors) are expected in a WRS scene.	Intgr	4	LLLL : Scan Lines (up to 5600 nominal)
Band IDs	ETM+ Format 1 Bands used in generating the multibrowse image.	Char	3	BBB : where each B is in the range 1-6.
Starting Detectors	The ETM+ band detector number used in to start the subsampling operation.	Intgr	6	AABBCC: where AA, BB and CC are Detectors in the range 1-16

Subsample Factor	The subsampling (number of detector/pixels to skip) scheme used in input data reduction. A factor of 2 reduces an input image to 1/4th; a factor of 4 reduces the input to its 1/16th, and so on. The LPS uses a subsample by 2 (1 run) in its multibrowse scheme.	Intgr	1	SS : Subsampling factor (2-16), nominally 2, 4, 8 and 16
Wavelet Runs	The number of Wavelet runs used in input data reduction. Each run reduces the input size to its 1/4th. The LPS uses 2 Wavelet runs in its multibrowse scheme.	Intgr	1	W : 1-9
HDF/JPEG Compression Factor	The HDF/JPEG data compression factor used in reducing the total size of a multibrowse image to 1 MB or lower. This factor identifies the reduction in percentage to be applied to the input image/file.	Intgr	2	JJ : (00% - 75%) Nominally 60% for LPS multibrowse images.
Multibrowse Image Width (x)	The actual number of pixels per line in the multibrowse image	Intgr	4	WWWW : 512 - 1024
Multibrowse Image Length (y)	The actual number of image lines in this multibrowse image.	Intgr	4	LLLL : 512 - 1024
HDF Browse Format	Identifies the RIS24 browse format for converting the LPS multibrowse file to HDF.	Char	5	RIS24 for LPS
HDF Browse Interleave	The data interleave scheme used for converting the LPS multibrowse image to the HDF RIS24 format. Interleave by image scan-planes is recommended for LPS to maintain a 3 8-bit plane structure (all Red, Green and Blue pixels in separate planes) under the HDF scheme **(TBR).** This may or may not allow the users to read an HDF formatted multibrowse image by individual planes **(TBD** HDF utilities to extract/read image by scan-planes).	Char	1	I : P, S or B where: P - indicates an interleave by image scan-plane; S - indicates an interleave by image scans-linesand B - indicates a interleave by image pixels (bytes).

4.3.3 Multi-browse File Format

Specific details on the HDF formatted multibrowse image are provided in the HDF-EOS Primer for Version 1 EOSDIS (175-WP-001-001, April 1995).

Appendix A - LPS Output Files Reference Information

This appendix contains the follwing reference information:

a. Landsat 7 ETM+ Band-Pixel Alignment Table (Sample - **TBR)**

b. PCD by Data Categories as identified in the Landsat 7 DFCB

c. PCD Locator by Data Item Name

d. PCD Positions in a PCD Cycle

Table A-1: Landsat 7 ETM+ Band-Pixel Alignment Table
(Not an LPS Output File - For LPS Reference Only)

		Forward Scan -->		<-- Reverse Scan	
Detectors	No. of Detectors	West End	East End	West End	East End
Band 1 Even	8	186	8	188	6
Band 1 Odd	8	183	11	186	8
Band 2 Even	8	161	33	163	31
Band 2 Odd	8	158	36	161	33
Band 3 Even	8	136	58	138	56
Band 3 Odd	8	133	61	136	58
Band 4 Even	8	111	83	113	81
Band 4 Odd	8	108	86	111	83
Band 5 Even	8	66	128	68	126
Band 5 Odd	8	63	131	66	128
Band 7 Even	8	40	154	42	152
Band 7 Odd	8	37	147	40	154
Band 6 1	4	0	194	7	187
Band 6 2	4	12	182	15	179
Band 6 3	4	1	193	6	188
Band 6 4	4	12	181	14	180
Band 8 (Pan) Even	16	TBD	TBD	TBD	TBD
Band 8 (Pan) Odd	16	TBD	TBD	TBD	TBD

Notes:
1. To correct for Detector Layout Geometry, Multiplexer Sampling and Delay Times.
2. Ref. Landsat 6 L0 CCT Format Document June 1990

3. The number of pixels (bytes) starting from each end are discarded (shifted out and/or filled) because they contain indeterminate values.

A-2: PCD by Data Categories as identified in the Landsat 7 DFCB

PCD Group	PCD Item	Size (Bytes)	MJFM No.	Begin mnfm	End mnfm	Begin Word	End Word
ADS (all minor frames)	ADS-X1	2	All	0	127	3	4
	ADS-Y1	2	All	0	127	5	6
	ADS-Z1	2	All	0	127	7	8
	ADS-X2	2	All	0	127	11	12
	ADS-Y2	2	All	0	127	13	14
	ADS-Z2	2	All	0	127	15	16
	ADS-X3	2	All	0	127	19	20
	ADS-Y3	2	All	0	127	21	21
	ADS-Z3	2	All	0	127	23	24
	ADS-X4	2	All	0	127	27	28
	ADS-Y4	2	All	0	127	29	30
	ADS-Z4	2	All	0	127	31	32
	ADS-X5	2	All	0	127	35	36
	ADS-Y5	2	All	0	127	37	38
	ADS-Z5	2	All	0	127	39	40
	ADS-X6	2	All	0	127	43	44
	ADS-Y6	2	All	0	127	45	46
	ADS-Z6	2	All	0	127	47	48
	ADS-X7	2	All	0	127	51	52
	ADS-Y7	2	All	0	127	53	54
	ADS-Z7	2	All	0	127	55	56
	ADS-X8	2	All	0	127	59	60
	ADS-Y8	2	All	0	127	61	62
	ADS-Z8	2	All	0	127	63	64
	ADS-X9	2	All	0	127	66	67
	ADS-Y9	2	All	0	127	68	69
	ADS-Z9	2	All	0	127	70	71
	ADS-X10	2	All	0	127	74	75

	ADS-Y10	2	All	0	127	76	77
	ADS-Z10	2	All	0	127	78	79
	ADS-X11	2	All	0	127	82	83
	ADS-Y11	2	All	0	127	84	85
	ADS-Z11	2	All	0	127	86	87
	ADS-X12	2	All	0	127	90	91
	ADS-Y12	2	All	0	127	92	93
	ADS-Z12	2	All	0	127	94	95
	ADS-X13	2	All	0	127	98	99
	ADS-Y13	2	All	0	127	100	101
	ADS-Z13	2	All	0	127	102	103
	ADS-X14	2	All	0	127	106	107
	ADS-Y14	2	All	0	127	108	109
	ADS-Z14	2	All	0	127	110	111
	ADS-X15	2	All	0	127	114	115
	ADS-Y15	2	All	0	127	116	117
	ADS-Z15	2	All	0	127	118	119
	ADS-X16	2	All	0	127	122	123
	ADS-Y16	2	All	0	127	124	125
	ADS-Z16	2	All	0	127	126	127
ADS Temperature	ADS-X Temp1	2	All	108	109	72	72
	ADS-Y Temp2	2	All	110	111	72	72
	ADS-Z Temp3	2	All	112	113	72	72
	ADS Elec. A/D Temp	2	All	114	115	72	72
ADS Temp Sample Time	ADS-X Temp1-Sample Time	1	All	108	108	71	71
	ADS-Y Temp2-Sample Time	1	All	110	110	71	71
	ADS-Z Temp3-Sample Time	1	All	112	112	71	71
	ADS Elec. A/D Temp-Sample Time	1	All	114	114	71	71

Gyro Data	IMU-XA (Roll)	3	All	0	0	81	& 97
(Repeated at 4 minor frame			All	1	1	17	17
interval till minor frame# 127)	IMU-YA (Pitch)	3	All	0	0	113	113
			All	1	1	33	& 49
	IMU-ZA (Yaw)	3	All	1	1	81	& 97
			All	1	1	113	113
	IMU-XB (Roll)	3	All	2	2	81	& 97
			All	3	3	17	17
	IMU-YB (Pitch)	3	All	2	2	113	113
			All	3	3	33	& 49
	IMU-ZB (Yaw)	3	All	3	3	81	& 97
			All	3	3	113	113
Gyro Drift Data	Theta-BX	4	0	16	19	72	72
	Theta-By	4	0	20	23	72	72
	Theta-BZ	4	0	24	27	72	72
Attitude Estimate	EPA1	4	All	0	3	72	72
	EPA2	4	All	4	7	72	72
	EPA3	4	All	8	11	72	72
	EPA4	4	All	12	15	72	72
Time of Last SV Clock Update	SV Clock Last Update Time	6	0	28	33	72	72
SV Clock Drift	Time Drift Bias (C0)	2	0	36	37	72	72
	Time Drift Rate (C2)	2	0	38	39	72	72
	Time Drift Acceleration (C2)	2	0	40	41	72	72
Ephemeris	Position Coordinate X	4	0 & 2	50	53	72	72
	Position Coordinate Y	4	0 & 2	54	57	72	72

	Position Coordinate Z	4	0 & 2	58	61	72	72
	Velocity Coordinate X	4	0 & 2	62	65	72	72
	Velocity Coordinate Y	4	0 & 2	66	69	72	72
	Velocity Coordinate Z	4	0 & 2	70	73	72	72
	Position Coordinate X	4	1 & 3	16	19	72	72
	Position Coordinate Y	4	1 & 3	20	23	72	72
	Position Coordinate Z	4	1 & 3	24	27	72	72
	Velocity Coordinate X	4	1 & 3	28	31	72	72
	Velocity Coordinate Y	4	1 & 3	32	35	72	72
	Velocity Coordinate Z	4	1 & 3	36	39	72	72
ETM+ TLM /16.384 seconds	ETM TLM MF(2) mfs(16-30)	15	2	16	30	72	72
	Serial Word "A"	1	2	31	31	72	72
	Serial Word "B"	1	2	32	32	72	72
	Serial Word "C"	1	2	33	33	72	72
	Serial Word "D"	1	2	34	34	72	72
	Serial Word "E"	1	2	35	35	72	72
	Serial Word "F"	1	2	36	36	72	72
	Serial Word "G"	1	2	37	37	72	72
	Serial Word "H"	1	2	38	38	72	72
	Serial Word "I"	1	2	39	39	72	72
	ETM TLM MF(2) mfs(40-49)	10	2	40	49	72	72
ETM+ TLM / 4.096 seconds	Black Body Temperature (Isolated)	1	All	74	74	72	72
	CFPA Heater Current	1	All	75	75	72	72
	Calibration Shutter Flag Temperature	1	All	76	76	72	72
	Backup Shutter Flag Temperature	1	All	77	77	72	72

	Black Body Temperature (Control)	1	All	78	78	72	72
	Baffle Temperature (Heater)	1	All	79	79	72	72
	CFPA Control Temperature	1	All	80	80	72	72
	Mux 1 Electronics Temperature	1	0	81	81	72	72
	Mux 1 Power Supply Temperature	1	0	82	82	72	72
	Mux 2 Electronics Temperature	1	0	83	83	72	72
	Mux 2 Power Supply Temperature	1	1	81	81	72	72
	Serial Word "J"	1	1	82	82	72	72
	Serial Word "K"	1	1	83	83	72	72
	Serial Word "L"	1	2	81	81	72	72
	Serial Word "M"	1	2	82	82	72	72
	Serial Word "N"	1	2	83	83	72	72
	Serial Word "P"	1	2	84	84	72	72
	Serial Word "Q"	1	3	81	81	72	72
	Serial Word "R"	1	3	82	82	72	72
	Serial Word "S"	1	3	83	83	72	72
	ACS CPU Mode	1	3	84	84	72	72
Spacecraft ID	Spacecraft ID (ASCII)	1	0	96	96	72	72
Timecode (PCD Reference Time)	Timecode	7	0	96	102	72	72
PDF A/D Ground Reference	PDF A/D Ground Reference	2	All	116	117	72	72

Minor Frame Sync	Minor Frame Sync	3	All	0	127	0	2
Minor Frame ID	Minor Frame ID	1	All	0	127	65	65
Major Frame Identification	MJFM ID "0" = (S/C ID & Time)	7	0	96	103	72	72
	MJFM ID "1"	8	1	96	103	72	72
	MJFM ID "2"	8	2	96	103	72	72
	MJFM ID "3"	8	3	96	103	72	72
ETM+ On/Off Times	ETM+ On Time	6	0	42	47	72	72
	ETM+ Off Time	6	0	84	89	72	72

Table A-3: PCD Locator by Data Item Name

PCD Item	Size (Bytes)	MJFM No.	Begin mnfm	End mnfm	Begin Word	End Word
ACS CPU Mode	1	MF3	84	84	72	72
ADS Elec. A/D Temp	2	All	114	115	72	72
ADS Elec. A/D Temp-Sample Time	1	All	114	114	71	71
ADS-X Temp1	2	All	108	109	72	72
ADS-X Temp1-Sample Time	1	All	108	108	71	71
ADS-X1	2	All	0	127	3	4
ADS-X10	2	All	0	127	74	75
ADS-X11	2	All	0	127	82	83
ADS-X12	2	All	0	127	90	91
ADS-X13	2	All	0	127	98	99
ADS-X14	2	All	0	127	106	107
ADS-X15	2	All	0	127	114	115
ADS-X16	2	All	0	127	122	123
ADS-X2	2	All	0	127	11	12
ADS-X3	2	All	0	127	19	20
ADS-X4	2	All	0	127	27	28
ADS-X5	2	All	0	127	35	36
ADS-X6	2	All	0	127	43	44
ADS-X7	2	All	0	127	51	52
ADS-X8	2	All	0	127	59	60
ADS-X9	2	All	0	127	66	67
ADS-Y Temp2	2	All	110	111	72	72
ADS-Y Temp2-Sample Time	1	All	110	110	71	71
ADS-Y1	2	All	0	127	5	6
ADS-Y10	2	All	0	127	76	77
ADS-Y11	2	All	0	127	84	85
ADS-Y12	2	All	0	127	92	93
ADS-Y13	2	All	0	127	100	101
ADS-Y14	2	All	0	127	108	109
ADS-Y15	2	All	0	127	116	117

ADS-Y16	2	All	0	127	124	125
ADS-Y2	2	All	0	127	13	14
ADS-Y3	2	All	0	127	21	21
ADS-Y4	2	All	0	127	29	30
ADS-Y5	2	All	0	127	37	38
ADS-Y6	2	All	0	127	45	46
ADS-Y7	2	All	0	127	53	54
ADS-Y8	2	All	0	127	61	62
ADS-Y9	2	All	0	127	68	69
ADS-Z Temp3	2	All	112	113	72	72
ADS-Z Temp3-Sample Time	1	All	112	112	71	71
ADS-Z1	2	All	0	127	7	8
ADS-Z10	2	All	0	127	78	79
ADS-Z11	2	All	0	127	86	87
ADS-Z12	2	All	0	127	94	95
ADS-Z13	2	All	0	127	102	103
ADS-Z14	2	All	0	127	110	111
ADS-Z15	2	All	0	127	118	119
ADS-Z16	2	All	0	127	126	127
ADS-Z2	2	All	0	127	15	16
ADS-Z3	2	All	0	127	23	24
ADS-Z4	2	All	0	127	31	32
ADS-Z5	2	All	0	127	39	40
ADS-Z6	2	All	0	127	47	48
ADS-Z7	2	All	0	127	55	56
ADS-Z8	2	All	0	127	63	64
ADS-Z9	2	All	0	127	70	71
Backup Shutter Flag Temperature	1	All	77	77	72	72
Baffle Temperature (Heater)	1	All	79	79	72	72
Black Body Temperature (Control)	1	All	78	78	72	72
Black Body Temperature (Isolated)	1	All	74	74	72	72
Calibration Shutter Flag Temperature	1	All	76	76	72	72
CFPA Control Temperature	1	All	80	80	72	72
CFPA Heater Current	1	All	75	75	72	72

EPA1	4	All	0	3	72	72
EPA2	4	All	4	7	72	72
EPA3	4	All	8	11	72	72
EPA4	4	All	12	15	72	72
ETM TLM MF(2) mfs(16-30)	15	MF2	16	30	72	72
ETM TLM MF(2) mfs(40-49)	10	MF2	40	49	72	72
ETM+ Off Time	6	MF0	84	89	72	72
ETM+ On Time	6	MF0	42	47	72	72
Gyro Select Data	1	MF0	34	34	72	72
IMU-XA (Roll)	2	All	0	0	81	& 97
IMU-XA (Roll)	1	All	1	1	17	17
IMU-XB (Roll)	2	All	2	2	81	& 97
IMU-XB (Roll)	1	All	3	3	17	17
IMU-YA (Pitch)	2	All	0	0	113	113
IMU-YA (Pitch)	1	All	1	1	33	& 49
IMU-YB (Pitch)	2	All	2	2	113	113
IMU-YB (Pitch)	1	All	3	3	33	& 49
IMU-ZA (Yaw)	2	All	1	1	81	& 97
IMU-ZA (Yaw)	1	All	1	1	113	113
IMU-ZB (Yaw)	2	All	3	3	81	& 97
IMU-ZB (Yaw)	1	All	3	3	113	113
Minor Frame ID	1	All	0	127	65	65
Minor Frame Sync	3	All	0	127	0	2
MJFM ID "0" = (S/C ID & Time)	7	MF0	96	103	72	72
MJFM ID "1"	8	MF1	96	103	72	72
MJFM ID "2"	8	MF2	96	103	72	72
MJFM ID "3"	8	MF3	96	103	72	72
Mux 1 Electronics Temperature	1	MF0	81	81	72	72
Mux 1 Power Supply Temperature	1	MF0	82	82	72	72
Mux 2 Electronics Temperature	1	MF0	83	83	72	72
Mux 2 Power Supply Temperature	1	MF1	81	81	72	72
PDF A/D Ground Reference	2	All	116	117	72	72
Position Coordinate X	4	MF0	50	53	72	72
Position Coordinate X	4	MF1	16	19	72	72

Position Coordinate X	4	MF2	50	53	72	72
Position Coordinate X	4	MF3	16	19	72	72
Position Coordinate Y	4	MF0	54	57	72	72
Position Coordinate Y	4	MF1	20	23	72	72
Position Coordinate Y	4	MF2	54	57	72	72
Position Coordinate Y	4	MF3	20	23	72	72
Position Coordinate Z	4	MF0	58	61	72	72
Position Coordinate Z	4	MF1	24	27	72	72
Position Coordinate Z	4	MF2	58	61	72	72
Position Coordinate Z	4	MF3	24	27	72	72
Serial Word "A"	1	MF2	31	31	72	72
Serial Word "B"	1	MF2	32	32	72	72
Serial Word "C"	1	MF2	33	33	72	72
Serial Word "D"	1	MF2	34	34	72	72
Serial Word "E"	1	MF2	35	35	72	72
Serial Word "F"	1	MF2	36	36	72	72
Serial Word "G"	1	MF2	37	37	72	72
Serial Word "H"	1	MF2	38	38	72	72
Serial Word "I"	1	MF2	39	39	72	72
Serial Word "J"	1	MF1	82	82	72	72
Serial Word "K"	1	MF1	83	83	72	72
Serial Word "L"	1	MF2	81	81	72	72
Serial Word "M"	1	MF2	82	82	72	72
Serial Word "N"	1	MF2	83	83	72	72
Serial Word "P"	1	MF2	84	84	72	72
Serial Word "Q"	1	MF3	81	81	72	72
Serial Word "R"	1	MF3	82	82	72	72
Serial Word "S"	1	MF3	83	83	72	72
Spacecraft ID (ASCII)	1	MF0	96	96	72	72
SV Clock Last Update Time	6	MF0	28	33	72	72
Theta-BX	4	MF0	16	19	72	72
Theta-By	4	MF0	20	23	72	72
Theta-BZ	4	MF0	24	27	72	72
Time Drift Acceleration (C2)	2	MF0	40	41	72	72

Time Drift Bias (C0)	2	MF0	36	37	72	72
Time Drift Rate (C2)	2	MF0	38	39	72	72
Timecode	7	MF0	96	102	72	72
Velocity Coordinate X	4	MF0	62	65	72	72
Velocity Coordinate X	4	MF1	28	31	72	72
Velocity Coordinate X	4	MF2	62	65	72	72
Velocity Coordinate X	4	MF3	28	31	72	72
Velocity Coordinate Y	4	MF0	66	69	72	72
Velocity Coordinate Y	4	MF1	32	35	72	72
Velocity Coordinate Y	4	MF2	66	69	72	72
Velocity Coordinate Y	4	MF3	32	35	72	72
Velocity Coordinate Z	4	MF0	70	73	72	72
Velocity Coordinate Z	4	MF1	36	39	72	72
Velocity Coordinate Z	4	MF2	70	73	72	72
Velocity Coordinate Z	4	MF3	36	39	72	72

Table A-4: PCD Positions in a PCD Cycle

PCD Item	Size (Bytes)	MJFM No.	Begin mnfm	End mnfm	Begin Word	End Word
Minor Frame Sync	3	All	0	127	0	2
ADS-X1	2	All	0	127	3	4
ADS-Y1	2	All	0	127	5	6
ADS-Z1	2	All	0	127	7	8
ADS-X2	2	All	0	127	11	12
ADS-Y2	2	All	0	127	13	14
ADS-Z2	2	All	0	127	15	16
ADS-X3	2	All	0	127	19	20
ADS-Y3	2	All	0	127	21	21
ADS-Z3	2	All	0	127	23	24
ADS-X4	2	All	0	127	27	28
ADS-Y4	2	All	0	127	29	30
ADS-Z4	2	All	0	127	31	32
ADS-X5	2	All	0	127	35	36
ADS-Y5	2	All	0	127	37	38
ADS-Z5	2	All	0	127	39	40
ADS-X6	2	All	0	127	43	44
ADS-Y6	2	All	0	127	45	46
ADS-Z6	2	All	0	127	47	48
ADS-X7	2	All	0	127	51	52
ADS-Y7	2	All	0	127	53	54
ADS-Z7	2	All	0	127	55	56
ADS-X8	2	All	0	127	59	60
ADS-Y8	2	All	0	127	61	62
ADS-Z8	2	All	0	127	63	64
Minor Frame ID	1	All	0	127	65	65
ADS-X9	2	All	0	127	66	67
ADS-Y9	2	All	0	127	68	69
ADS-Z9	2	All	0	127	70	71
EPA1	4	All	0	3	72	72

ADS-X10	2	All	0	127	74	75
ADS-Y10	2	All	0	127	76	77
ADS-Z10	2	All	0	127	78	79
IMU-XA (Roll)	2	All	0	0	81	& 97
ADS-X11	2	All	0	127	82	83
ADS-Y11	2	All	0	127	84	85
ADS-Z11	2	All	0	127	86	87
ADS-X12	2	All	0	127	90	91
ADS-Y12	2	All	0	127	92	93
ADS-Z12	2	All	0	127	94	95
ADS-X13	2	All	0	127	98	99
ADS-Y13	2	All	0	127	100	101
ADS-Z13	2	All	0	127	102	103
ADS-X14	2	All	0	127	106	107
ADS-Y14	2	All	0	127	108	109
ADS-Z14	2	All	0	127	110	111
IMU-YA (Pitch)	2	All	0	0	113	113
ADS-X15	2	All	0	127	114	115
ADS-Y15	2	All	0	127	116	117
ADS-Z15	2	All	0	127	118	119
ADS-X16	2	All	0	127	122	123
ADS-Y16	2	All	0	127	124	125
ADS-Z16	2	All	0	127	126	127
IMU-XA (Roll)	1	All	1	1	17	17
IMU-YA (Pitch)	1	All	1	1	33	& 49
IMU-ZA (Yaw)	2	All	1	1	81	& 97
IMU-ZA (Yaw)	1	All	1	1	113	113
IMU-XB (Roll)	2	All	2	2	81	& 97
IMU-YB (Pitch)	2	All	2	2	113	113
IMU-XB (Roll)	1	All	3	3	17	17
IMU-YB (Pitch)	1	All	3	3	33	& 49
IMU-ZB (Yaw)	2	All	3	3	81	& 97
IMU-ZB (Yaw)	1	All	3	3	113	113
EPA2	4	All	4	7	72	72

EPA3	4	All	8	11	72	72
EPA4	4	All	12	15	72	72
Black Body Temperature (Isolated)	1	All	74	74	72	72
CFPA Heater Current	1	All	75	75	72	72
Calibration Shutter Flag Temperature	1	All	76	76	72	72
Backup Shutter Flag Temperature	1	All	77	77	72	72
Black Body Temperature (Control)	1	All	78	78	72	72
Baffle Temperature (Heater)	1	All	79	79	72	72
CFPA Control Temperature	1	All	80	80	72	72
ADS-X Temp1-Sample Time	1	All	108	108	71	71
ADS-X Temp1	2	All	108	109	72	72
ADS-Y Temp2-Sample Time	1	All	110	110	71	71
ADS-Y Temp2	2	All	110	111	72	72
ADS-Z Temp3-Sample Time	1	All	112	112	71	71
ADS-Z Temp3	2	All	112	113	72	72
ADS Elec. A/D Temp-Sample Time	1	All	114	114	71	71
ADS Elec. A/D Temp	2	All	114	115	72	72
PDF A/D Ground Reference	2	All	116	117	72	72
Theta-BX	4	MF0	16	19	72	72
Theta-By	4	MF0	20	23	72	72
Theta-BZ	4	MF0	24	27	72	72
SV Clock Last Update Time	6	MF0	28	33	72	72
Time Drift Bias (C0)	2	MF0	36	37	72	72
Time Drift Rate (C2)	2	MF0	38	39	72	72
Time Drift Acceleration (C2)	2	MF0	40	41	72	72
ETM+ On Time	6	MF0	42	47	72	72
Position Coordinate X	4	MF0	50	53	72	72
Position Coordinate Y	4	MF0	54	57	72	72
Position Coordinate Z	4	MF0	58	61	72	72
Velocity Coordinate X	4	MF0	62	65	72	72
Velocity Coordinate Y	4	MF0	66	69	72	72
Velocity Coordinate Z	4	MF0	70	73	72	72
Mux 1 Electronics Temperature	1	MF0	81	81	72	72
Mux 1 Power Supply Temperature	1	MF0	82	82	72	72

Mux 2 Electronics Temperature	1	MF0	83	83	72	72
ETM+ Off Time	6	MF0	84	89	72	72
MJFM ID "0" = (S/C ID & Time)	7	MF0	96	103	72	72
Spacecraft ID (ASCII)	1	MF0	96	96	72	72
Timecode	7	MF0	96	102	72	72
Position Coordinate X	4	MF1	16	19	72	72
Position Coordinate Y	4	MF1	20	23	72	72
Position Coordinate Z	4	MF1	24	27	72	72
Velocity Coordinate X	4	MF1	28	31	72	72
Velocity Coordinate Y	4	MF1	32	35	72	72
Velocity Coordinate Z	4	MF1	36	39	72	72
Mux 2 Power Supply Temperature	1	MF1	81	81	72	72
Serial Word "J"	1	MF1	82	82	72	72
Serial Word "K"	1	MF1	83	83	72	72
MJFM ID "1"	8	MF1	96	103	72	72
ETM TLM MF(2) mfs(16-30)	15	MF2	16	30	72	72
Serial Word "A"	1	MF2	31	31	72	72
Serial Word "B"	1	MF2	32	32	72	72
Serial Word "C"	1	MF2	33	33	72	72
Serial Word "D"	1	MF2	34	34	72	72
Serial Word "E"	1	MF2	35	35	72	72
Serial Word "F"	1	MF2	36	36	72	72
Serial Word "G"	1	MF2	37	37	72	72
Serial Word "H"	1	MF2	38	38	72	72
Serial Word "I"	1	MF2	39	39	72	72
ETM TLM MF(2) mfs(40-49)	10	MF2	40	49	72	72
Position Coordinate X	4	MF2	50	53	72	72
Position Coordinate Y	4	MF2	54	57	72	72
Position Coordinate Z	4	MF2	58	61	72	72
Velocity Coordinate X	4	MF2	62	65	72	72
Velocity Coordinate Y	4	MF2	66	69	72	72
Velocity Coordinate Z	4	MF2	70	73	72	72
Serial Word "L"	1	MF2	81	81	72	72
Serial Word "M"	1	MF2	82	82	72	72

Serial Word "N"	1	MF2	83	83	72	72
Serial Word "P"	1	MF2	84	84	72	72
MJFM ID "2"	8	MF2	96	103	72	72
Position Coordinate X	4	MF3	16	19	72	72
Position Coordinate Y	4	MF3	20	23	72	72
Position Coordinate Z	4	MF3	24	27	72	72
Velocity Coordinate X	4	MF3	28	31	72	72
Velocity Coordinate Y	4	MF3	32	35	72	72
Velocity Coordinate Z	4	MF3	36	39	72	72
Serial Word "Q"	1	MF3	81	81	72	72
Serial Word "R"	1	MF3	82	82	72	72
Serial Word "S"	1	MF3	83	83	72	72
ACS CPU Mode	1	MF3	84	84	72	72
MJFM ID "3"	8	MF3	96	103	72	72

Acronym List

AOS	Acquisition of Signal
BER	Bit Error Rate
CCB	Configuration Control Board
CCSDS	Consultative Committee on Space Data System
DCN	Document Change Notice
EDC	EROS Data Center
EROS	Earth Resources Observation System
ETM+	Enhanced Thematic Mapper plus
F&PS	Functional and Performance Specification
GSFC	Goddard Space Flight Center
ICD	Interface Control Document
LAN	Local area network
LP DAAC	Land Processes Distributed Active Archive Center
LPS	Landsat 7 Data Processing System
MOC	Mission Operations Center
MO&DSD	Mission Operations and Data Systems Directorate
NASA	National Aeronautics and Space Administration
UTC	Universal Time Code